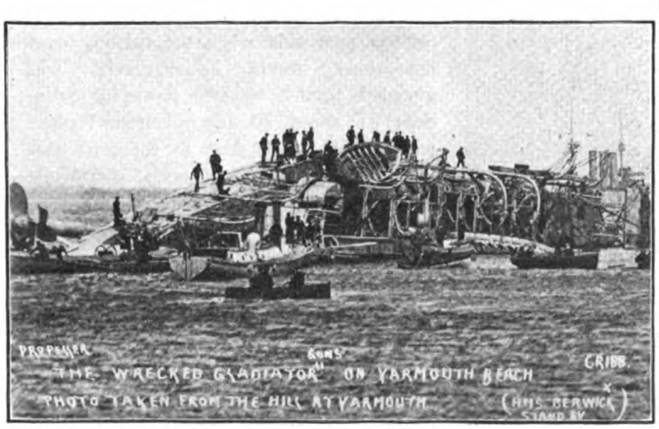
THE MARINE REVIEW

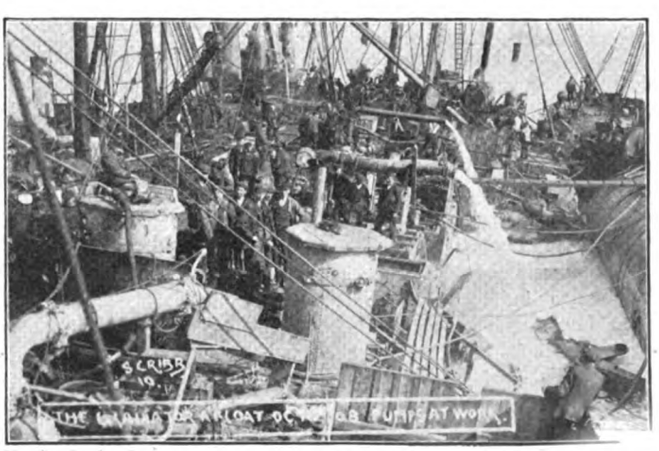
VOL. 38. CLEVELAND, NOVEMBER 5, 1908. NEW YORK No. 19

A Really Wonderful Salvage Feat.

Now that this really remarkable and in many respects unique salvage achievement in the whole history of shipping is an accomplished fact, it is perhaps worthy of being illustrated and described in more detail than has been possible up to the present, owing to the impossibility of obtaining from the wreck officers the necessary information while they were so wholly occupied in their work.

It will be remembered that the Gladiator foundered in the English channel on April 25 this year after having been in collision with the American liner St. Paul. The Gladiator is a British cruiser which cost over $2,000,000, and her successful refloating is of importance because it has revealed the capabilities and resources of the Liverpool Salvage Association, and at the same time brought to an important stage a scheme entertained by the British admiralty for the equipment of a salving section of the service. This is by no means the first remarkable salvage case which has made the Liverpool Salvage Association and its chief surveyor and wreck officer, Capt. F. W. Young, M. I. M. E., famous, for after the British naval authorities last year exhibited their failure either to save the wrecked battleship Montagn or recover her guns, Capt.

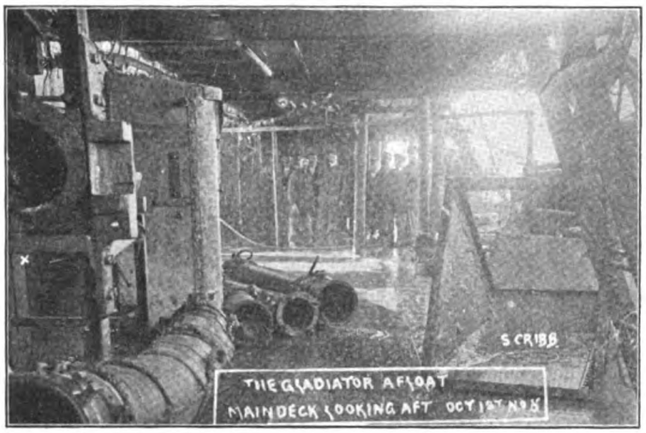


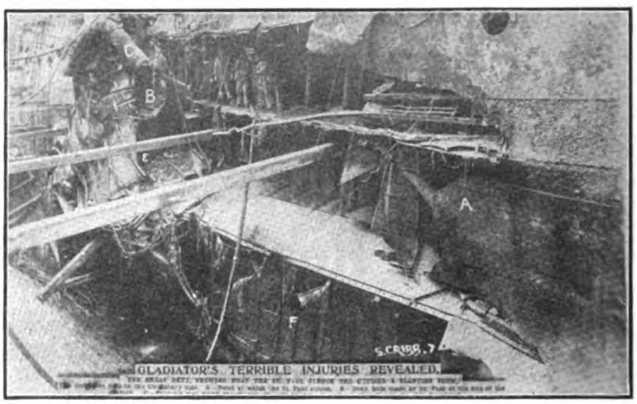


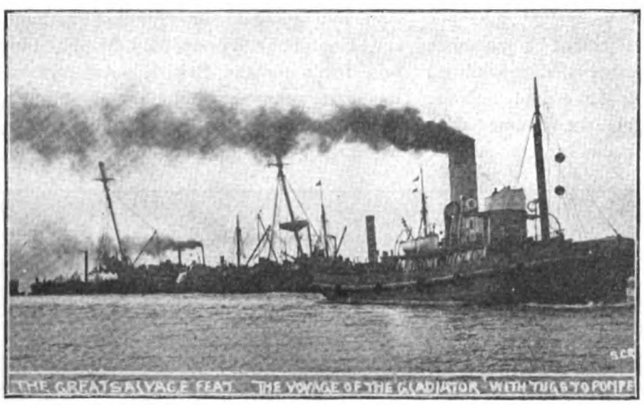
Young succeeded afterwards in getting every gun ashore and everything else worth saving. It will thus be understood why the Liverpool Salvage Association and Capt. Young have figured so prominently in this work, but in justice to everybody concerned, Capt. Young has been highly fortunate in the assistance both of his own association and the admiralty and also of apparatus placed at his disposal. But it has nevertheless been the brains of Capt. Young that has invented means that have been at all effective. The six large air cylinders which were built at his suggestion as well as the powerful haulage station erected ashore played a most important part in bringing the vessel to an upright position.

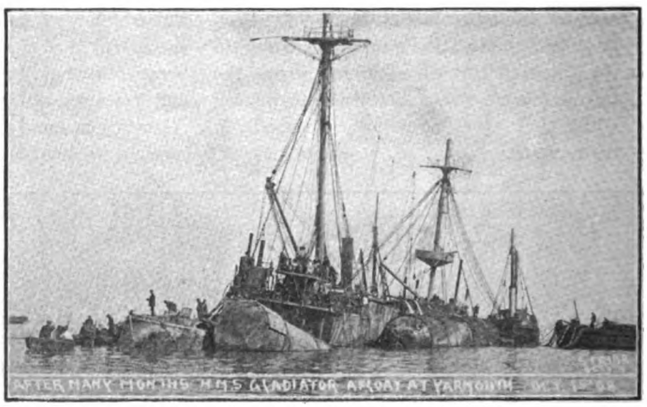
But it would be better to give these details of salvage in their proper order. At the beginning of May it was decided to dismantle the ship and recover the guns, and this done the work was concentrated on endeavoring to make her watertight and ready for when the water was to be pumped out. Then it was found necessary on the advice of Capt. Young to build at Portsmouth dock yard four huge cylinders 10 ft. diameter and 100 ft. long, having a combined lifting power of 650 tons which were used in righting the vessel and keeping her afloat. These having been filled with water were sunk and made fast to the submerged side of the Gladiator with steel hawsers. By a special process of air application they were emptied of water and immediately became airtight, buoyant and capable of the strain indicated.

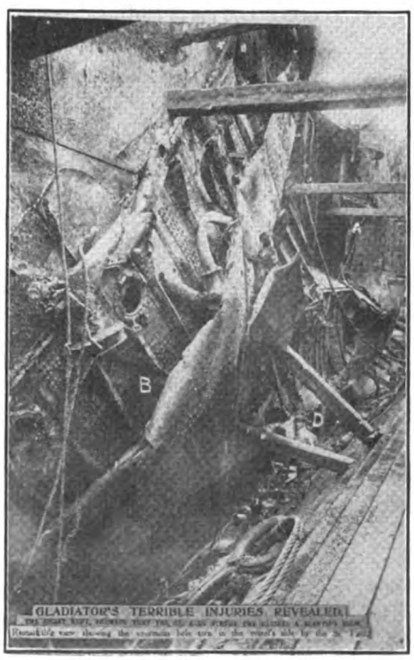
To prevent the Gladiator being carried into deep water by powerful currents it was further decided to build on shore two powerful winches with large boilers for power purposes, and four enormous bollards which were embedded in 450 tons of concrete. The hawsers used in this case were steel wire 8 in. in thickness and 500 fathoms in length. When the first attempt at moving the ship on June 4 was made, it was shown that these shore hawsers possessed all the power anticipated, but the effort revealed certain defects in other ways. It was not however until Sept. 6 that the work of lifting her was seriously and earnestly undertaken, the time meanwhile having been spent in matters of important detail without which being absolutely perfect the vessel could not be kept afloat when raised. The danger of the Gladiator tilting over on her port side when the turning over operations should be successful was guarded against by two powerful cylinders of about 70 ft. in circumference which were made fast to the port side by powerful steel hawsers. Meanwhile after two or three weeks the boisterous weather settled into a perfect calm, and the whole set of powerful pumps were set to work, and the shore hawsers made to exert their great strength. The hawsers trained over the tripods to the wrecking steamer Ranger were also brought into use to pull the vessel over. The result was remarkable for



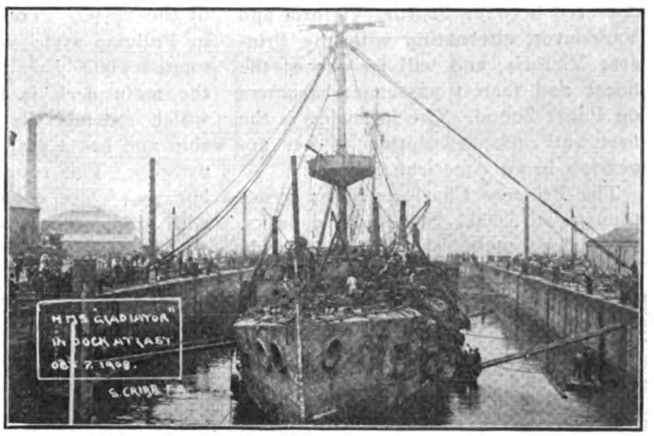


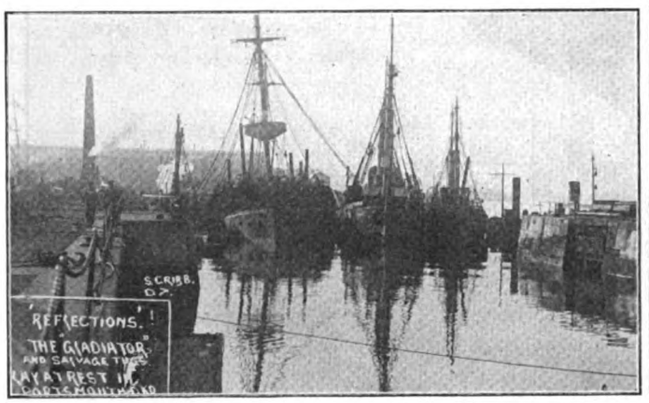


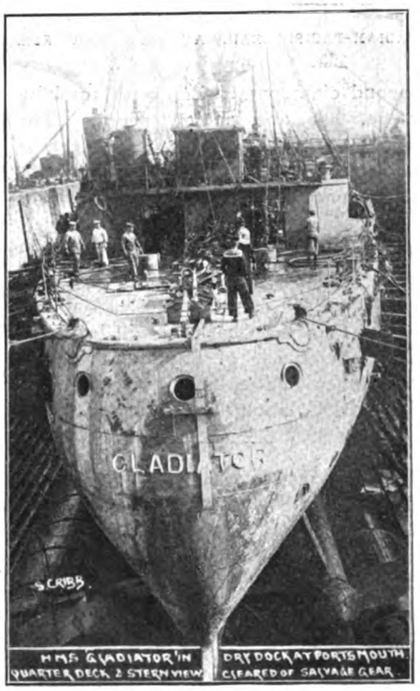


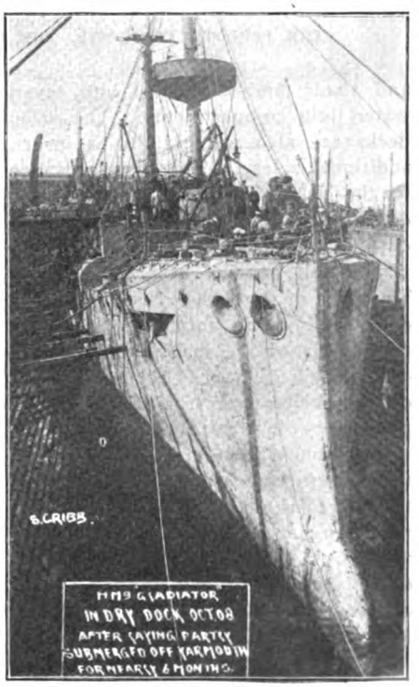


on that day, Sept. 9, the wrecked warship which once lay completely on her side was brought within three degrees of an even keel. The ship was however but partially afloat, due to the large fracture on her side as she lay, but it now became possible to patch this up by constructing a dam on the inside. This done enabled the pumps to do the remaining work for giving her buoyancy sufficient to float her into drydock. A point of some interest in the operation is that prior to the raising process 200 tons of pig iron had been placed on the bilge keel of the port side to help in bearing over the vessel when she was being pulled over. It now only remains to be added that the vessel was successfully docked in drydock at Portsmouth, there to be dealt with as the admiralty may direct. To say the least the refloating of this large and heavy warship is a wonderful feat of marine engineering.









NEW STEAMER PRINCESS CHARLOTTE FOR CANADIAN PACIFIC RY. PACIFIC COAST SERVICE.

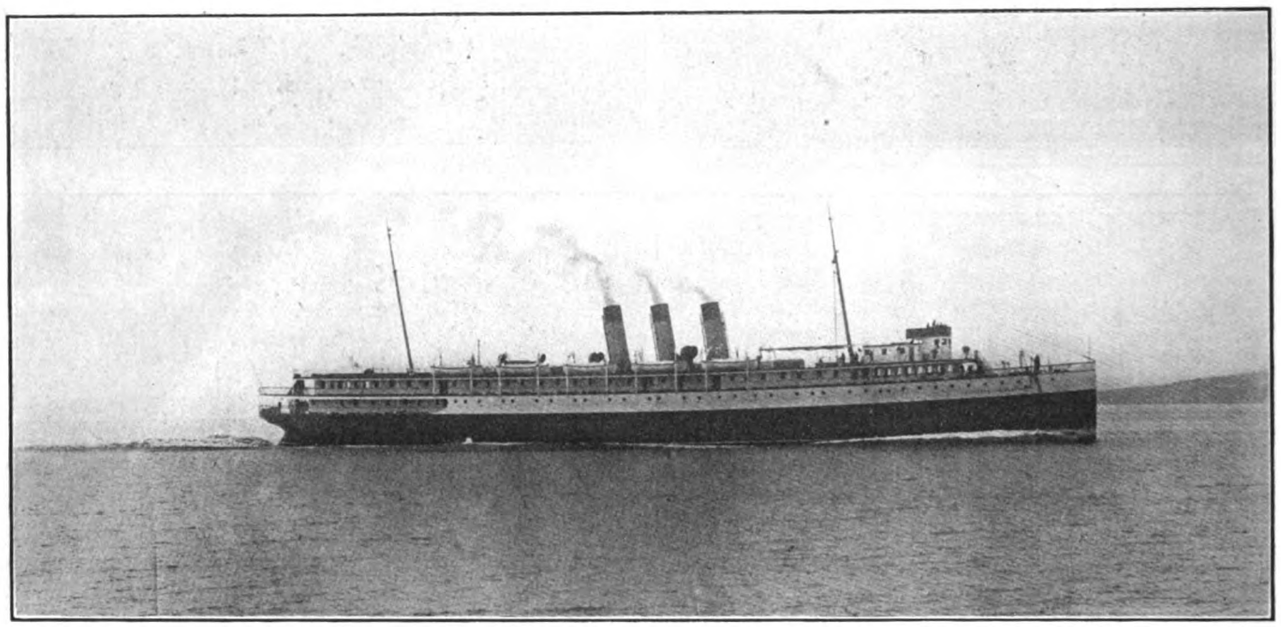
Considerable interest is manifest on the Pacific coast in the new steamer, Princess Charlotte, now building on the Clyde for the Canadian Pacific Railway Co. The new Princess will be operated between Seattle, Victoria and Vancouver, alternating with the Princess Victoria, and will be one of the finest and fastest passenger steamers on Puget Sound. The following is the first authentic description of her appearing in an American journal:

The Princess Charlotte has a gross tonnage of 3,600. She has five decks, the orlop, main, shelter, promenade and shade, and is divided into seven water tight compartments. The orlop decks are also water tight to insure additional safety. The main entrance to the vessel is through water tight doors in the ship's side on the shelter deck forward, which lead to an entrance hall paneled in polished teak. The floor of this hall is laid with terra cotta and white interlocking rubber tiles. Aft of the main entrance is a central hall. There is accommodation on the shelter deck for 176 first class passengers in two and three berth staterooms. There are also 12 special, three berth rooms and four rooms fitted as bridal chambers, two in figured mahogany and two in Domingo satinwood. At the after end of the shelter deck is a central hall similar to the one forward, and also a ladies' retiring room which is paneled in light Austrian oak. On the promenade deck forward and aft are two open wells which give light to the shelter deck halls. On this deck are also accommodations for 104 first class passengers in two berth rooms furnished similarly to the shelter deck rooms.

At the forward end is the observation room which is the main feature of the vessel. This room is fitted up in Pullman style with large elliptical topped plate glass windows. Aft on the main deck is the dining saloon, which extends the full width of the ship and has a seating capacity of 133 persons. This room is framed in mahogany, white enameled and relieved with gold. Forward on the main and shelter decks is accommodation for 48 second class passengers, with smoking room, bar and dining room. The space amidships on the main deck is reserved for freight.

The engines are triple expansion, of four cylinders each and are balanced on the Yarrow, Schlick, Tweedy system. They drive twin screws. Her speed is from 20 to 22 miles per hour.

The Princess Charlotte will leave the Clyde in charge of Captain Troup in November and should arrive at Victoria, B. C., about December 20.



THE PRINCESS CHARLOTTE, THE CANADIAN-PACIFIC RAILWAY CO.'S NEW STEAMER FOR PACIFIC COAST SERVICE.

The Texas City Steamship Co. has chartered the steamer Lewis Luckenbach, with a capacity of 6,000 tons. She left New York Oct. 14 with a full cargo, thus making four steamers which this company now has in service between New York and Texas.

SCREW PROPULSION IN SHALLOW RIVERS.

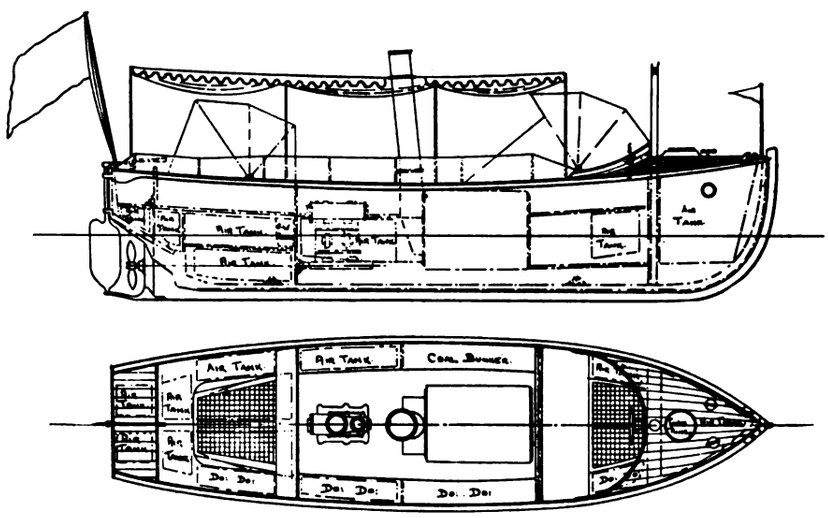
There has recently been built and tried for speed on the Clyde a steam pilot launch of very light draught, a feature of which is the tunnel principle of construction at the stern, whereby, with the propeller working in solid water, within the tunnel, propulsive efficiency is secured under conditions of the very lightest draught. By means of this arrangement it is possible to use screw-propelled vessels in shallow rivers where, under ordinary circumstances, only side or stern-wheel steamers would be satisfactory. Although somewhat novel to Clyde ship building practice, this feature has been introduced in a number of vessels by other firms throughout the kingdom—notably Yarrow & Co. at Poplar—now of Scotstoun on the Clyde. The little vessel is named the Chin, and has been constructed for the Irrawaddy Flotilla Co., Ltd., Burmah, by whom she will be employed on the Chindwin river for laying mark buoys. The Chindwin—a tributary of the Irrawaddy—is in the dry season cumbered with many shoals, rendering navigation very difficult, hence the need for the little craft. The hull, of galvanized iron, was built by the Ardrossan Ship Building Co., Ltd., Ardrossan, the machinery being supplied by Messrs. McKie & Baxter, Govan. The mean draught of the launch on trial was 21 in., and the engine was kept running continuously at 370

revolutions, the speed attained being fully two miles per hour above the speed specified. While the Chin is probably the first launch of this type built and tried on the Clyde, vessels in which the tunnel principle is a feature will in all likelihood become more common. Included in the work at present under way in Messrs. Yarrow's new yard are four vessels, all to be propelled by twin screws working in stern tunnels. One of the vessels is a shallow draught gunboat, 120 ft. in length, for the Portuguese government. Another is a shallow draught steamer for service in the river Magdalena in South America, and still another for navigating the upper reaches of one of the rivers in New Zealand. There is also a set of twin-screw machinery for a shallow draught steamer being built by Messrs. Rennie, London, for the Tigres & Euphrates Navigation Co. The tunnels in which the propellers of these vessels are worked will be fitted with Yarrow's patent hinged flap aft, the whole arrangement securing the maximum efficiency under all conditions of draught.

STEAM PINNACES FOR THE ARGENTINE NAVY.

The accompanying illustrations relate to 12 steam pinnaces constructed by Messrs. Simpson, Strickland & Co., Ltd., of Dartmouth, England, for the Argentine navy, six being 28 ft. in length, and six 25 ft. The two classes of boat have an extreme beam of 7 ft., and the builders have been rigidly tied down to conditions of weight, draught, freeboard, etc., and in addition a mean speed of seven knots on the measured mile had to be obtained with all fittings on board, full tanks and bunkers and eight men. The keel and gunwale are of Canadian elm, the stem, apron, stern-post, deck beams, etc., are of English oak, while the rudder frame and spindle, together with all bollards, fairleads, steering wheel, stern band, etc., are of gun metal, so that it will be seen that the boats are not only of great strength, but of very high class. The machinery consists of a set of compound inverted surface-condensing engines, having cylinders 4½ in. and 9 in. in diameter, with a 5½-in. stroke, giving about 30 I. H. P. at 400 R. P. M. Each boat, according to the specifications, had to maintain her full power and speed on a trial of four consecutive hours, with the result that the 28-ft. boats did about three-quarters of a knot in excess of their contract, and satisfactorily passed through this somewhat arduous trial, and in all cases were accepted at the first attempt by the inspecting officer. The 25-ft. boats have engines with cylinders 4 in. and 8 in. in diameter, with a 5-in. stroke, giving about 23 I. H. P. at 400 R. P. M. The contract speed of 6½ knots in these was also exceeded by three-quarters of a knot.

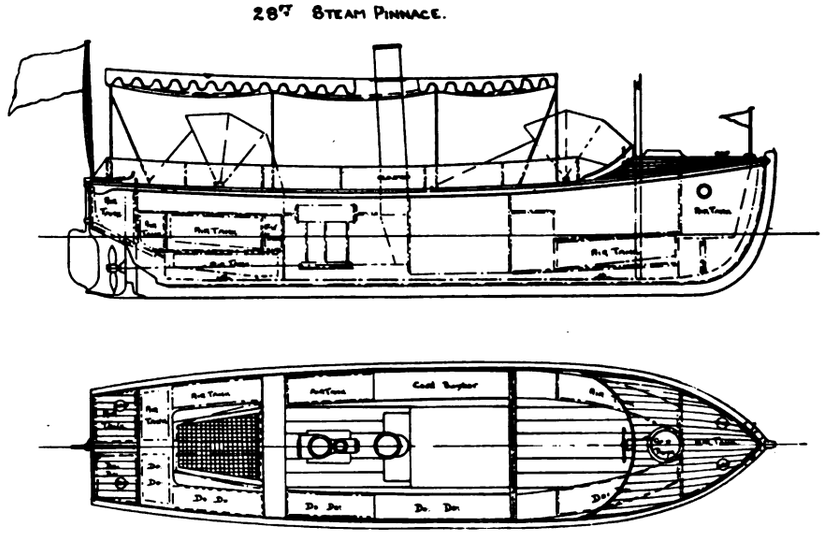
25' STEAM PINNACE.



The steamboat inspection service has established a new sub-district which will include the Hawaiian Islands. The post will be filled by Capt. William Howe and Carl Lehmers, at present assistant inspectors at San Francisco, the former having been promoted to be inspector of hulls and the latter to be inspector of boilers. James A. Sullivan, who is at present the assistant clerk to the San Francisco board, is to be with the new board in the capacity of clerk. Offices are to be established in the Alexander Young building at Honolulu and the new inspectors will be under the supervision of Capt. Bermingham, supervising inspector for the Pacific coast. It has heretofore been the custom to transfer the Alaskan inspectors to Honolulu during the winter months but the growing need of the islands made the establishment of a new office imperative.

The Antarctic exploration ship Pourquoi Pas, commanded by the French scientist Dr. Charcot, has been at Rio Janeiro for some time receiving coal, food, supplies, water and medicine. These were all supplied freely by the Brazilian government.

28' STEAM PINNACE.



DEVICE FOR DETACHING LIFE-BOATS.

Should the shipping man be asked what are the essential features of a perfect apparatus for launching lifeboats he would probably say that, first, the boat chocks must in no way impede the rapid clearing of the boat; second, the davits must be so designed that as few men as possible are required in getting the boat swung out; third, both ends of the boat must lower away simultaneously, and, last, both ends of the falls must disengage simultaneously. He might also add that the less skilled handling the apparatus requires the more commendable it will appear to the master or mate harassed with constantly changing crews and heavy passenger lists. Nothing can be more pitiable than the occasional reports of apparatus which failed to work, or automatic gear which somehow did not act when the boats were being swung clear or cast off from a stranded or sinking ship. Falls that have fouled, defective davits, and the empty lifeboat dangling smashed and useless from a single fall, with the other fall swinging free, are no uncommon adjuncts of the derelict.

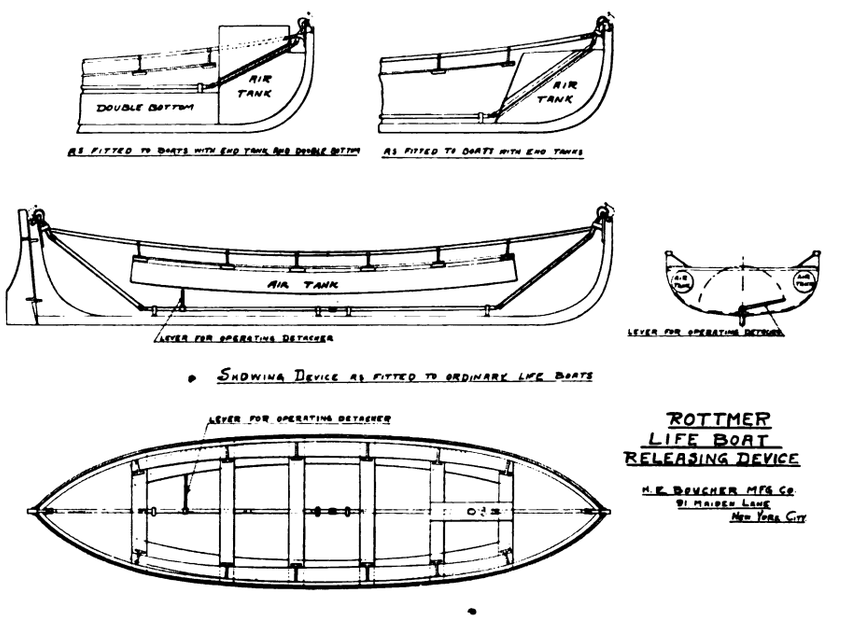
The recent rapid increase in the size and capacity of passenger vessels has brought forcibly home to shipping companies the necessity of equipping their vessels with rapid and reliable lifeboat handling apparatus, and the demand for such apparatus has been the means of bringing several devices, each with its individual merits, before the ship owner and builder. The result is that a steadily increasing percentage of vessels, afloat and under construction, are abandoning the old style of gear for the more up-to-date and efficient equipment.

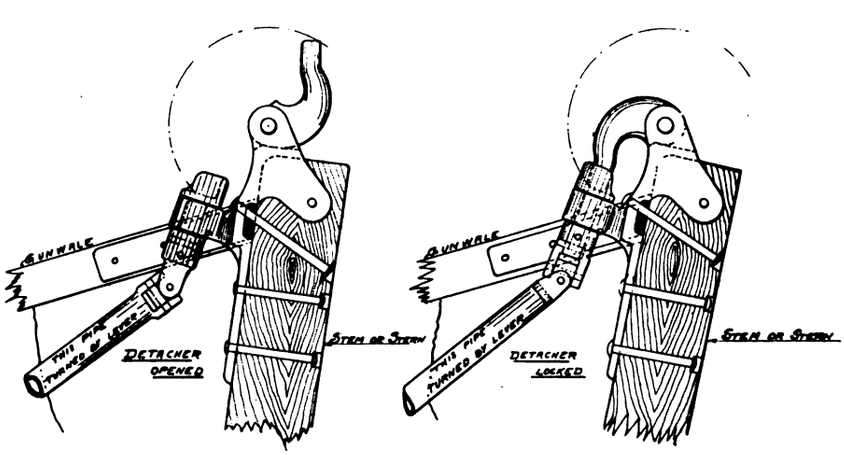
The accompanying drawings illustrate one of the most commendable inventions in lifeboat handling gear of recent years, an apparatus giving the coxswain full control when the boat is to be cast off from the falls, and so designed that both ends disengage simultaneously. This device, known as the Rottmer life boat detacher, has been eminently successful in meeting the requirements in the regulations covering this subject framed by the board of supervising inspecting steamboat inspectors of the United States. The regulation is as follows: "Vessels shall have the life boats required by law, provided with suitable boat-disengaging apparatus, so arranged as to allow such boats to be safely launched while such vessels are under speed or otherwise, and so as to allow such disengaging apparatus to be operated by one person, disengaging both ends of the boat simultaneously from the tackles by which it may be lowered to the water."

The Rottmer detacher is operated by a lever placed near the stern of the boat, adjacent to the coxswain's post, the simple movement of throwing this lever over athwartship being sufficient to clear the boat from the falls. The entire apparatus is constructed of galvanized cast steel parts connected to a galvanized iron piping, bronze bushings and pins being fitted wherever there is any wear. It is so designed as to be easily installed, no matter what the construction of a boat may be, and the fact that there is absolutely nothing automatic in its action is one of its most meritorious features.

In detail, the device consists of a ¾-in. pipe placed longitudinally in the center of the boat, as shown in the illustrations, this pipe having attached the operating lever aforementioned. The disengaging hooks are attached to the longitudinal pipe in such manner that they are open or closed according to the position of the lever. When not in action the lever, which is about 18 in. long, rests close to the side of the boat. The movement transmitted through the pipe rotates two sockets secured to the breasthooks on each end. These sockets have an open side which, by the rotary movement of the pipe, comes in direct fore and aft position, allows two swinging hooks bolted to the breasthooks, and to which the falls are shackled—to open, and the boat is cast off.

The whole weight of the boat and its occupants rests solely on the cast steel swinging hooks, the releasing apparatus at no time being under any strain. The longitudinal pipe is





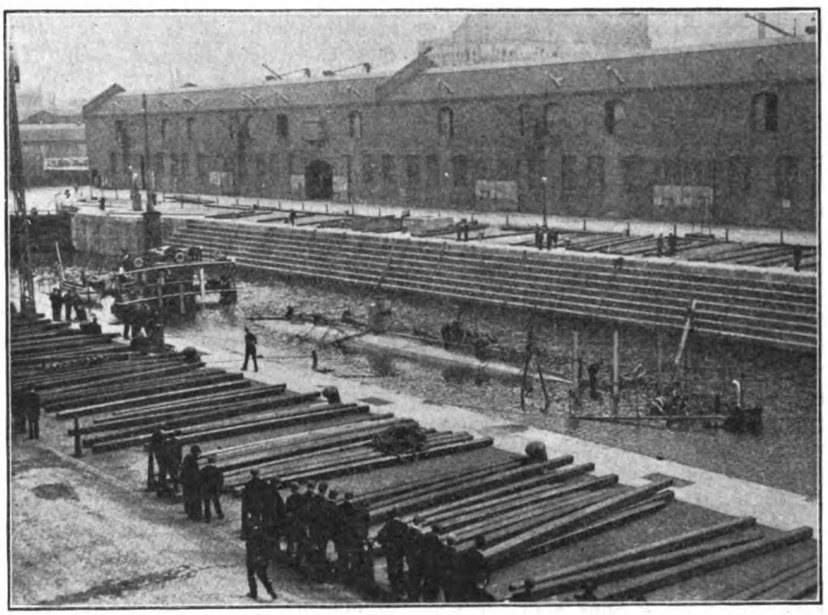
equipped with five universal joints, one of which, situated in the center of the boat, allows for any possible sagging or hogging movement of the boat.

The Rottmer life boat detacher is being manufactured by the H. E. Boucher Mfg. Co., 91 Maiden Lane, New York City, a firm intimately associated with marine matters of all kinds. The original device afforded opportunity for considerable improvement when brought to the attention of Mr. H. E. Boucher, but has been perfected by him to meet all commercial requirements through simplifying it as much as possible. Whatever standard articles could be worked in to advantage are used in the construction of the apparatus.

The United States army transport service has adopted the device and it is now being installed in a number of the transport vessels.

A UNIQUE SHIPPING CRAFT TO TRANSPORT SUBMARINES.

In British shipping circles there is just now considerable interest centered in a special type of ship which has been designed and built exclusively for transporting two Japanese submarines to Japan. The steamer, which is aptly called the Transporter, is a steel vessel about 242 ft. long, 38 ft. beam, and about 850 tons register. She is fitted with triple-expansion engines of 800 H. P., and she steams about nine knots an hour. The story of the contract for building the submarines and for delivering them to Japan, which was secured by Messrs. Vickers, Sons & Maxim, is of considerable interest. The submarines are of a special type, an improvement on the American Holland in the original design of which the Japanese admiralty introduced features which are said to be quite new. Their construction has been taken part in by a number of Japanese admiralty engineers. The submarines being now completed, they will be carried away as finished articles—more or less ready for operation—from British waters direct to Youkuska, 18 miles distant from Yokohama, and one of the great naval ports of Japan. The submarines are each 100 ft. long, so that the longitudinal space required for a shipment of this nature is very great, and the proper stevedoring of them is quite beyond the range of ordinary experience. Each weighs 250 tons. An important factor in the stevedoring arrangements is the firm foundation required for the fixing of the submarines in a position of absolute rigidity. This has been achieved by laying down two "cradles," each more than 100 ft. long, in the hold of the Transporter. On these cradles the keels of the submarines have been placed and firmly held, but in a very strange manner, which has been described as an unprecedented feat in marine engineering. The Transporter had first



SHOWING THE TRANSPORTER SUBMERGED WITH HER BURDEN ON DECK.

of all to be submerged as she lay on the blocks in one of the Liverpool dry docks, and the two submarines floated over her. As the water was pumped out they gradually dropped on their respective cradles, but it should be added that only one submarine was dealt with at one time. The water was let into the Transporter again a second time to allow the other to be put aboard. Our illustration shows the first of them being dealt with, the water at the time having been sufficiently lowered to show the outline of the submerged Transporter, and the submarine floating immediately above her cradle on board the ship. The work was safely accomplished on Sept. 9, and about the end of September the Transporter will be ready to begin her long journey to Japan. The work has been carried out under the greatest privacy, the public and photographers being warned from approaching the particular dock while the work was in operation. In general outline the submarines are similar to those commonly in use by the British admiralty, but they are said to possess several important improvements.

NEW FIRE BOAT FOR SOUTH AMERICA.

A petrol motor fire boat has just been constructed by Messrs. Merryweather & Sons for the Buenos Ayres & Southern Dock Co. The pumps, which have a total capacity of 700 gallons per minute, are driven by two petrol engines each 55 brake horsepower, whilst the propulsion of the boat is effected by means of hydraulic jets at sides, delivered from the fire pump. The pumps discharge through six outlets on deck, or their entire power can be delivered through a monitor in one large jet. The vessel can also be used for salvage operations, a suction connection being provided for this purpose.

The Nippon Yusen Kaisha, the great Japanese steamship company, is gradually replacing all its white captains with Japanese. The reasons given are that economy is necessary, Japanese masters being paid much less than white men, and also that there is a growing disinclination on the part of crews to serve under foreigners. However, it is apparent that as the native standard has been gradually rising the policy of displacing outsiders has spread to all departments and industries of the island empire. The progress of the nation in matters commercial is nowhere better demonstrated than in its shipping, the Nippon Yusen Kaisha being an excellent example. It is the third largest mercantile marine company of the world and maintains extensive services across the Pacific and around Japan.

The Electrical Plant and Means of Interior Communication of a Modern Ocean-Going Passenger and Cargo Vessel.

CHAS. J. DOUGHERTY.

Most engineers have some knowledge of the size and capacity of isolated electrical plants on shore, but, I am free to say, few perhaps, realize what is being done today in the electrical line on modern ocean-going vessels.

On shore plants the generating units and switchboards are allowed ample space in the rooms provided for same, but on shipboard the poor electrical engineer is compelled to install his apparatus in as small a space as possible, and at times this space is totally inadequate for the proper handling of the apparatus. This crowding is necessary, however, for the vessel is a compact unit and every inch of space counts, so we are not allowed spacious quarters for the apparatus which forms the very heart and vitals of the electrical installation.

The plant which I shall describe to you this evening is installed on the new steamship Momus, built by the William Cramp & Sons Ship and Engine-Building Co., Philadelphia. This vessel is for the Atlantic coastwise trade of the Southern Pacific Co., New York.

The Momus and Antilles are single-screw vessels with reciprocating engines and Scotch boilers. The third sister Creole, built at Fore River, has Curtis turbines. All three vessels are steel and of a type that has never been equaled before for coastwise service. They are deep-sea vessels of unusual strength and capable of navigating any waters of the globe, and their comfortable sea-going qualities, excellently arranged and airy passenger accomodations, large, roomy cargo holds, high speed, and beautiful models make them the undisputed peers of all coasting vessels.

I give herewith a brief description of the general dimensions and the internal arrangements of these vessels:

Length	440 ft.
Beam	53 ft.
Depth	37 ft.
Low draught	26 ft.
Dead weight capacity	4,500 gross tons
Displacement	10,600 gross tons

The Momus and Antilles are each fitted with three double-ended and four single-ended Scotch boilers, the former being the largest boilers built in America.

These boilers are 15 ft. 4 in. in diameter by 21 ft. 4 in. long; they have eight furnaces each. The total grate surface is 770 sq. ft. and the heating surface is 26,500 sq. ft. The steam pressure carried is 234 pounds. All boilers are connected to a single smokestack.

The steamship Creole is fitted with Babcock & Wilcox water-tube boilers, and superheaters are installed also, as this vessel is equipped with steam turbines for motive power and is of the twin-screw type. All three vessels having the same dimensions and displacement, this will enable the owners to settle for themselves the question as to the merits of reciprocating engines and turbine engines, as the results abtained in the economy of fuel, speed developed, and economy of maintenance can readily be compared.

The reciprocating engines of the Momus and the Antilles are of the vertical three-cylinder triple-expansion direct-acting marine type. Each vessel has one engine installed and it is of entirely new design. The diameters of the cylinders are as follows:

High pressure	34 in.
Intermediate pressure	57 in.
Low pressure	104 in.
The common stroke is	63 in.

The cranks are set at an angle of 120 degrees with each other. The engine-bed plates are of cast iron with heavy cast iron housings supporting the backs of the cylinders with wrought steel forged columns in the front. The engine is designed to develop about 7,000 H. P. when making 70 R. P. M. with a steam pressure of 234 pounds at the boilers.

The valve gear is of the Stephenson type with double bar links working directly on the valve stem. The engine is also fitted with a floating lever reversing engine with an oil controlling cylinder bolted to the low pressure housing. The turning engine for the main engine is a double cylinder vertical inverted type located on the after engine room bulkhead. There are six crank shaft bearings and six steady bearings. There is also a steady bearing at each end of the thrust bearing, forming part of this bearing. A main surface condenser is located on the starboard side of the engine room.

Each vessel is fitted with a double bottom and the hull is divided into 22 watertight compartments. The vessels are especially constructed for handling cargo in the most expeditious and most economical manner. They are fitted with four overall hatches with folding covers and numerous side ports. The masts, although gracefully tapering and located with a pleasing rake, are really modern derrick posts, and practically all rigging has been dispensed with.

The cargo holds have a capacity for about 335,000 cu. ft. of freight, or about 100,000 cu. ft. more than any other vessel of the type at present afloat.

The coal bunkers will store 1,700 tons of coal and the water tanks will hold about 800 tons of water.

Each vessel carries a large refrigerating plant and cold-storage boxes for ship's provisions, also selected cargo spaces with a capacity of about four carloads of perishable freight.

The crew of each vessel numbers about 117, 23 of which are allotted to the deck department, 46 in the engine room, and 48 in the stewards' department.

These ships are designed for a sea speed of 16 knots per hour, or about 18½ statute miles, and the speed is higher than the maintained speed of any vessel engaged today in American coastwise service.

The interior arrangements are worthy of a small description, but even this cannot do justice to the commodious and handsomely furnished interiors; so, therefore, I shall give only a brief outline thereof.

The first class passenger accommodations are in the superstructure amidships, there being rooms arranged for the accommodation of 152 passengers. All the state rooms are outside rooms —they are light, airy, well furnished, and comfortable, and it is to be noted that any part of the first class passengers' quarters, including the dining saloon, library, smoking room, barber

shop, toilet rooms, etc., can be reached from any other part of the vessel without the necessity of stepping out on deck, a convenience not always found on all first class vessels.

Four luxurious suites are located on the upper deck. These suites consist of a parlor, bed room, and bath. The dining room on the lower deck is finished in pure colonial style in rich mahogany and it will seat all the passengers at one time.

The library is finished and decorated in Italian renaissance design with curly maple furnishings.

The smoking room, bar and barber shop are finished in oak, Flemish design.

The sanitary arrangements of the vessel are excellent; solid porcelain ware is used throughout and the sides of the toilet rooms are lined with white marble.

On the aft quarter-deck are located accommodations for 58 second class passengers, and any number of steerage passengers, up to about 500, can be comfortably carried on the main deck forward.

The above description of these vessels may have seemed probably lengthy, but I feel that my audience should know the details and realize the excellent product turned out by one of Philadelphia's greatest industries, the William Cramp & Sons Ship & Engine Building Co.

The day of the oil lamp or candle bracket for lighting vessels is past. Modern vessels demand the use of electricity for lighting. These vessels which I have described with all their luxurious furnishings and joiner work would appear like dismal caverns were it not for the art of the electrical engineer in illuminating and beautifying their interiors. The incandescent lamp today plays no small part in the interior furnishings of vessels, and harmonious effects can readily be brought out or marred by poor lighting arrangements. The electrical plant, therefore, on one of these large passenger vessels is worthy of your consideration.

I shall now describe the electrical plant of the steamship Momus, although the installations on all three vessels, it must be remembered, are exact duplicates.

GENERATING SETS.

The generating units are located in the main engine room on the port side forward.

There are two 75 K. W. and one 10 K. W. sets installed. These sets are placed on a raised foundation equal in height to the first working platform grating of the main engine. The foundation consists of structural iron beams built up from the engine room floor to the deck above; heavy cross beams join with these and run outboard to the vessel's side. A heavy steel plate the shape of each generating set base is fastened to the steel structure as described and forms a rigid and non-vibrating foundation. Considering the high speed of the large generating sets, no vibration is noticeable when these sets are running up to full load and full speed.

The small 10 K. W. generating set is a General Electric Co. marine type, 110-volt, direct-connected, with single cylinder engine and forced lubrication. This set is installed to take care of the ordinary day load of the vessel when at sea, and it can also be used when the vessel is discharging cargo at the docks. The set runs nicely and meets all the conditions for which it was intended. The 75 K. W. sets probably will interest you the most, as they are steam turbine sets.

A Curtis steam turbine is directly connected by means of a flexible coupling to a General Electric Co. direct-current generator. You will note that the turbine is of the horizontal type and the turbine and generator are each equipped with two bearings and the set is assembled on a rigid bed plate which is cast all in one piece. Great care is taken in lining up these sets, as a very slight non-alignment will produce serious vibration troubles.

The turbine is of the two-stage condensing type, each stage having two bucket wheels and one set of intermediate or fixed buckets.

The nozzles are machined from solid castings and, being carefully lined up during assembly, do not require adjustment. Between stages is a water separator, the drip from which is piped to the vessel's bilge. Steam is admitted to the steam chest through a combined throttle and emergency valve, and from this is distributed to the several first stage nozzles through governing mechanism.

The turbines operate at a speed of 2,400 R. P. M. and are supplied with steam at 230 lb. pressure. The high speed of operation makes the question of lubrication a very interesting one. All working parts of the valve gear, including the oil reservoir or the hollow governor lever, are oiled by hand. The hollow governor lever is filled with 600° cylinder oil, and this is done once a day.

The main bearings of the machine are furnished with forced lubrication from an oil pump on the end of the generator shaft. This pump contains two independent systems, one for the bearings and one for the valve mechanism. The relief valve for the valve gear pump should operate at about 80 lb. and the one for the bearings at 6 to 10 lb. Gages for both systems are supplied with each set. All four pillow blocks are provided with auxiliary oil wells and rings. The bearings are of the self-aligning, ball-seated, babbitt-lined type and are made in halves. The end play of the turbine shaft is limited at each end of the governor and bearing by a roller thrust bearing and the end play is about 0.015 in. The speed regulation of the turbine is maintained by varying the number of first stage nozzles in action to the proportion of the variations of load, steam being admitted independently to the several nozzle bowls through four plain poppet type valves.

Perhaps the most interesting part of the steam turbine would be to describe to you the governing mechanism, but I will say that this would require a lengthy and intricate detail, and the length of my paper will permit me but to simply touch upon it.

The governor consists of a pair of adjustable weights acting on a tension spring; all movement is borne upon knife edges and a slight adjustment of speed may be made by means of a spanner nut. The governor spindle terminates in a hardened steel ball which runs in phosphor-bronze ball seats in the governor lever. The working travel of the governor spindle, that is, the travel necessary to open or close all valves, is 3/8 in. and the total travel available is 1/2 in. The essential feature of the valve governing mechanism is a hydraulic plunger principle governing a pilot valve, which in turn operates the poppet valves to the nozzle bowls. Each turbine has two emergency governors mounted on the outer governor ring. They consist of a spiral or clock spring, the free end of which flies outward at a speed of 2,600 revolutions and trips a trigger. This tripping of the trigger releases a weight, which closes the main throttle valve. This valve is of the poppet type, the spindle being moved up or down by a hand wheel through two sets of tog-

gles joining a hand wheel to a yoke on the valve spindle.

The General Electric Co. experienced considerable trouble at first with the shaft packings on these 75 K. W. sets. It is to be remembered that the operating steam pressure is 230 lb., and the speed of the shaft is 2,400 revolutions. These are the two fixed quantities and the shaft packing was the unknown one. After much experimenting it was found that the best results were obtained from carbon.

The above covers the description of the turbine part of the set, but there is another side to be considered, that is, the operation and efficiency of these turbine sets, and I will now briefly give you these data.

These turbine sets are guaranteed by the General Electric Co. to have a speed regulation of 2 per cent from no load to full load with a momentary permissible swing of 4 per cent with sudden large variations of load. The governor can be adjusted to give a closer range, but this is not advisable, as it makes the governing mechanism more delicate, and, consequently, not as stable.

The turbines were designed for 250 lb. steam pressure, but as the highest steam pressure available for testing purposes at the Lynn works of the General Electric Co. was 175 lb., the steam consumption readings which were taken on test had to be corrected to 250 lb. pressure, this being the requirement of the guaranteed specifications.

With 250 lb. steam pressure, 28 in. of vacuum, and 100° F. superheat, the steam consumption at full load was 24.5 lb. This figure is equivalent to about 16.5 lb. steam per B. H. P. under the conditions given. The 24.5 lb. at full load is expressed in pounds per kilowatt delivered at the generator terminals, assuming the generator efficiency at 90 per cent, which is approximately correct. The generators connected to the turbines are of the latest and most approved General Electric Co. type. They have four poles, are compound wound, the voltage is 110, and they are equipped with two commutators on account of the brush friction due to the high speed of the set. The brushes are specially treated by the General Electric Co. and they are of the carbon type, and they advise that these brushes be not replaced by brushes of other make without first being advised by them. The generators met the temperature guarantees of 45° C. maximum rise for 24 hours full load and 60° C. rise after two hours at 25 per cent overload, the room temperature being based on 25° C.

I believe these turbine sets are the first installation of the kind on merchant vessels for coastwise trade, and I am pleased to state that they have given excellent results in practical operation on the steamship Momus.

The switchboard is of white marble and consists of three panels; the outside panels are for the 75 K. W. sets and the center panel for the 10 K. W. set. The panels are securely bolted to an angle iron framing and the weight of the board is entirely taken by cast iron pedestals, four in number.

Each dynamo has an overload circuit breaker mounted at the top of the panel and the necessary indicating instruments, such as ammeters and voltmeters, are installed.

There are 14 feeder switches, 10 200 amperes and four 300 amperes capacity. These are the double-pole, double-throw type with enclosed fuses at the bottom of the board.

The two 75 K. W. sets are arranged to operate in parallel and they are connected to one set of bus bars. The 10 K. W. set is connected to an independent set of bus bars. Therefore any circuit can be connected to the 75 K. W. sets or to the 10 K. W. set as may be desired. It is, however, to be remembered that when the 75 K. W. sets are in operation, the 10 K. W. set is usually shut down.

There are five lighting feeders, one searchlight, one cargo circuit, one ventilation, and four heating circuit feeders. The bus wires for the 75 K. W. sets consist of 1,000,000 cm. cable.

As the space allotted to the switchboard is very small, it was necessary to crowd the apparatus, and the equalizing switch for the 75 K. W. sets was not placed on the switchboard, but on the side of one of the above mentioned sets.

There are no other special features on this switchboard which are worthy of mention.

A searchlight is a necessity on board a coastwise vessel, and the importance and usefulness of this piece of electrical apparatus is not overestimated. It serves to pick up buoys in channels, to signal between vessels at sea, and is very useful in the vessel making a dock at night time—in fact, its value is always appreciated by up-to-date captains.

This vessel is equipped with a 24-in. searchlight with pilot house control and is of the General Electric Co. make. The light is installed on top of the pilot house and projects a beam of light of sufficient density to render plainly discernible on a clear, dark night a light colored object 10 by 20 ft. in size at a distance of not less than 5,000 yds. The lamp produces the best results when taking about 50 or 60 amperes of current. The lamp is of the horizontal carbon type and is designed for both hand and automatic feed. A rheostat is used to cut down the voltage from 110 to about 45 volts, and this rheostat is located back of the main switchboard. After this rheostat is once set to give the correct amperage of the lamp it need not be adjusted.

FIXTURES.

In the state rooms, saloons, library, smoking room, and passenger quarters special ornamental fixtures are installed, and the design and finish of these fixtures harmonize with the interior furnishings.

Special attention was given to the library and smoking room fixtures. These were designed with special reference to the general style of these rooms, the library being on Louis XVI style and the smoking room on the Dutch or Flemish.

In the steerages, engine rooms, fire rooms, cargo holds, and all places where there is any moisture or exposure to the weather, fixtures with a steam tight globe and a heavy protecting guard are installed.

The vessel is wired throughout on the two-wire system and feeders from the switchboard connect to panel boards located on the different decks. These panel boards are of two types, namely, non-watertight and watertight; the former are located in the passenger spaces and the latter in the steerages and machinery spaces.

The panel boards are of slate, and circuit switches, double pole type with enclosed fuses, are mounted thereon.

The non-watertight panel boards are incased in hardwood closets with slate side linings and present a very neat appearance in the rooms where they are located.

The watertight type of distribution panel is something special and it is our standard design. The encasing metal of the box is cast iron or brass and the cover on the face is made absolutely watertight by means of a soft rubber gasket placed inside a groove designed for it. The various circuit leads run out from this box in conduit and the feeder to the bus

bars comes in from the bottom and is also in conduit.

The panel boards are the distributing centers for the lighting circuits in the immediate vicinity and not over 12 lights are installed on any circuit leading therefrom.

The drop in volts to the farthest lamp does not exceed three, and all feeder wires are figured on a basis of 1,000 cm. per ampere carried. No wire smaller than No. 14 B. & S. is used, and all wires over No. 12 B. & S. are stranded. The highest grade of rubber covered wire was used and the insulation of the wire consisted of a white compound next to the conductor, then a 30 per cent best grade Para vulcanized compound over this, a tape, and two woven braids.

Moldings are used in the living spaces, but in special cases the wires were encased in flexible woven conduit. This was done behind panel work or where it was impracticable to run either molding or conduit.

In the engine rooms, fire rooms, cargo holds, and in all exposed places, galvanized iron enameled conduit, known by the trade name of "Galvoduct," was installed. The necessary junction boxes, outlet receptacles, switches, and wiring accessories required for the conduit system were supplied from our regular stock.

In the state rooms the switches for turning off and on the lights are of the flush type such as we find in ordinary high grade house wiring, and they represent a very high grade. Therefore you are to note that every convenience of the passenger was carefully considered in detail.

Government and insurance regulations require vessels to display certain signal lights between sunset and sunrise. Vessels provided with an electrical plant have installed running lights equipped with incandescent lamps. Electricity is peculiarly adapted to the illumination of ships' running lights, since it furnishes a ready means of providing an indicator or tell-tale which will both visibly and audibly indicate when the incandescent lamps installed in the running lights are accidentally extinguished.

The port, starboard, mast head, and range lights are connected to a tell-tale board. The board consists of a piece of black enameled slate and has mounted on it, for each running light connected, a snap switch, bell, and a single-pole, double-throw switch. The terminals at the bottom of the board are connected to the lighting mains and the snap switch controls the current to the running light circuit, which is connected to the upper terminals on the board. To avoid the inconvenience of replacing lamps inside of the running lights when in storms or rough weather, the running lights are equipped with two incandescent lamps, one of which burns and the other acts as a reserve to be thrown into circuit in case of a "burn out." The tell-tale board is, therefore, designed to take care of two lamps in each running light. The extra or reserve lamp is readily connected in circuit by means of a small knife switch at the top of the board. This can be thrown either to the right or the left, connecting the corresponding lamp in circuit. If at any time when current is on the main wires and the running lights are in circuit and burning, the lamp in the running light should go out, the indicator lamp on the tell-tale board will light up and the bell will also sound, thus giving immediate warning that this particular running light is extinguished.

ELECTRIC HEATING SYSTEM.

The passenger accommodations on these vessels are entirely dependent for heat upon electric heaters—there is nothing else to take their place. The electric heaters, therefore, are a very important piece of apparatus on these vessels as far as the passengers' comfort is concerned.

The electric heaters are rather a bold and unprecedented departure from the regular practice in vogue at present, namely, steam heating. But the electrical engineer has caused the steam engineer, to use a slang expression, "to sit up and take notice." The superintending engineer of the Southern Pacific Co. is entitled to the credit for this radical change in the heating system on these vessels. It must be acknowledged that electric heaters are superior to steam radiators in that they are more compact, weigh less, are much neater in appearance, more easily regulated, and last, but by far not least, they have no liquid to leak out. The heaters have proved themselves a success on these vessels and every one is highly pleased with them. Of course, we all know how easy it is to decide upon a new system, but when it comes down to actually selecting a piece of apparatus best suited for our needs—well, this is another story. There are many good electric heaters on the market, but after looking them over we decided that none of them actually suited the particular case.

Knowing the unlimited resources of the General Electric Co. and the high grade of engineering talent employed, we modestly put the problem of design for these electric heaters up to the heating engineering department of that company, and we only made a few skeleton ideas for them to work upon. Therefore I take great pleasure in showing you this evening the result of this company's labor.

The heating element is of a design known as the "cartridge unit," and it consists of a coil of edgewise wound German silver resistance ribbon enclosed in a brass casing. The coil is insulated from the casing by a covering of sheet mica and the turns of wire in the resistance coil are insulated from each other by means of an anhydrous mixture. This mixture is generously filled in between the turns, after which the coils are baked in a gas oven so that the mixture adheres firmly to the coil and forms a desirable insulator. The coil is then placed in the casing, the open ends of which are spun over a porcelain bushing. The bushing is thus held firmly on the end of the coil and the whole forms a strong construction. Internal leads from the ends of the coil project through the porcelain bushing and form a means of electrical connection to the unit. The outside of the unit casing is equipped with radiating strips of metal ribbon, which serve to dissipate the intense heat generated in the coil, which, I am informed, rises to 500 or 600 degrees Fahr.

The 750-watt heaters consist of two sections, each 4½ in. long, and have a hot resistance each of 32.4 ohms. These sections are assembled together end to end in the coil casing and German silver leads are brazed to their common juncture and to each end of the combined coil. By this means the two sections of the coil may be connected in series, one section alone or the two sections in multiple, thus giving the three degrees of heat called respectively "low," "medium," and "high," and corresponding in watts to 187, 375, and 750. The five-point heater switch for controlling these heaters is located at any convenient position on the state-room bulkhead. The switch is of the indicating dial type and gives the indications "low," "medium," "high," "off."

The large size or 1,800-watt heaters are located in passageways, in the main dining saloon, and other places where there is a large volume of air to be heated.

The heating units of the 1,800-watt heaters consist of two coils, each 9 in. long, and they have a hot resistance of 13.45 ohms. The connections and operation of these coils are exactly similar to those of the 750-watt heaters which I have described, with the exception that the coils are assembled in separate casings with a metal shoulder at their common juncture.

The stateroom heaters, which are 750 watts capacity, are mounted on the bulkhead and insulated therefrom by a pad of transite board, which acts as a heat-insulating material. It was found necessary after these heaters were installed on board the vessel to place Russia iron shields over them in the staterooms to prevent dust, and particularly the passengers from throwing refuse on top of the perforated casings, as the intense heat of the heaters would probably start a fire, for when these heaters are running up to full heat, or 750 watts, the unit shows a very dull red color; consequently you will understand that they are fairly hot, and particles of paper or refuse should not be allowed to come in contact with them, otherwise probably a fire will start, hence the necessity of placing shields over them.

On the trial trip of the steamship Momus, an accident such as this did actually happen. One of the guests threw a pillow over the heater in his stateroom, and in a very short time there was some smoke and a bad odor of burning feathers from this particular stateroom, and, I may remark, also a very badly scared man, who was the occupant of the stateroom.

Both sizes of electric heaters are neat in appearance and are exceptionally compact. The 750-watt heater measures 14½ in. long, 4½ in. wide, and 4⅝ in. high. The 1,800-watt heaters are 26 in. long, 14½ in. wide, and 4½ in. high. Both of the heaters have perforated covers. These covers are made out of heavy gage metal and will withstand any ordinary amount of abuse or injury.

Descriptions of apparatus are always interesting, but what everybody wants to know is, how well do these electric heaters work and do they really heat? I quote herewith an extract from the report of the representatives of the builders on board the Momus on her maiden trip from New York to New Orleans:

"When we left New York the thermometer was 15 degrees above zero, and the morning the vessel sailed she was cold as an ice house, for the reason that the ship's stewards had not turned on the electric heaters. By the time we were outside of Sandy Hook the vessel was well warmed up. This was a severe test of the heating system and the electric heaters proved themselves capable in every respect. The weather moderated very materially, and by Saturday the thermometer outside was up to 80 degrees, so that after two days out the heaters were not used."

There are 124 750-watt heaters and 40 1,800-watt heaters installed on each vessel. The heaters are capable of heating the vessel in the coldest weather and there is no inconvenience of heat from steam pipes when the vessel is in southern waters. This is something in itself which is worthy of consideration, and, in my opinion, the electrc heater is the only one to install on a vessel whose voyage involves a change of climate, hot to cold, or vice versa. Steam radiators may soon be a thing of the past on shipboard.

In the first and second cabin dining saloon and in some of the passenger suites direct-current fan motors 18 in. in diameter are installed. These fans were of the Sprague Electric Co. make, and there is a special wire guard placed over the lower half of the fan. This is to prevent any one being injured while the fan is running. Such accidents have happened and have resulted in heavy damage suits to vessel owners.

For ventilating the smoking room and the first-class toilet rooms, there were installed two 40-in. Sturtevant steel plate type fans, motor driven. These were placed on top of the deck house aft.

Your attention is called to the watertight casing around the motor and the controlling panel. This casing must be absolutely watertight, as the set is located in the open and everything must be accessible and yet absolutely watertight.

The dish washing machine and the ice cream freezer are located in the pantry and these are operated by electric motors. These machines require no special description, as they follow the standard practice of installation, which I am quite sure is familiar to all.

MEANS OF INTERIOR COMMUNICATION.

Most of us are familiar with the electric lighting of vessels. We all must recognize that modern vessels are equipped with lighting plants, but how many of us know anything about the means of interior communication on shipboard? The up-to-date first-class vessel is nothing more than a floating hotel complete with all the conveniences which one expects to find in a first-class hotel; therefore I believe that the following description of what constitutes the interior communication on a vessel will prove of interest.

On this vessel the following interior communication systems are installed:

Call bells.
Fire alarm.
Telephones.
Mechanical telegraphs.
Whistle operator.
Wireless telegraph.

Push buttons are installed in the public rooms and in all first-class and second class staterooms. Each button connects by wire with a marine-type needle-point annunciator.

This annunciator is located in the pantry. There are about 160 buttons installed and each button requires one wire to be run back to the annunciator. The amount of bell wire for this system alone is five miles. You will, therefore, realize that the call bell system in itself is not a very small installation.

Perhaps one of the most important systems on the vessel is the fire alarm or fire detecting system. The necessity of an instant fire alarm cannot be overestimated; in fact, only one service can exceed it in value—that which forewarns of the approach of fire, that which gives notice that the temperature has risen dangerously near the point of ignition. The latter service is one which the thermostat is expected to render, and the type of apparatus which does it I will now describe.

After carefully looking over the fire detecting apparatus at present on the market, we decided to adopt the type of fire alarm thermostat manufactured by the Montauk Fire Detecting Wire Co., of New York. This fire detecting wire unit can best be described as follows:

A copper conductor is coated first with a fusible alloy; second, with a concentric insulation; third, with a concentric conductor. The core conductor is connected in series with a battery, annunciator and concentric conductor. This forms the circuit. The circuit remains open as long as the concentric insulation is intact. Now the effect of exposure to heat higher than the critical temperature of the alloy is to cause it to fuse, and in fusing to expand. This expansion results in numerous radial lines of alloy being forced through the surrounding insulation. As this insula-

tion contains a fluxing compound, the alloy unites in a soldered connection with the concentric conductor, thus perfectly closing the circuit at many points.

The above covers the principle of the apparatus adopted by us, but owing to our special requirements for the thermostat system on this vessel, a special tube thermostat was designed. The fire detecting wire as described is bent into the shape of a horseshoe, and the ends passed into the cover of a porcelain receptacle.

Within this cover the core wire is permanently connected with the base of one binding post and the outside tube connected with another post. The interior of the cover is then filled with an insulating compound and the cover is sealed into a porcelain base. The thermostats are made to operate on a temperature of 160 or 200 degrees Fahr., and the porcelain base is colored red or green to distinguish the two temperature ratings. The thermostats are wired in multiple and are enclosed in steel outlet boxes with covers. This is necessary to prevent injury to them, as they are installed in the cargo holds and are subjected to more or less hard handling. All wires for thermostats are carried in iron conduit and the thermostats throughout the cargo holds connect to a special fire alarm watertight type of annunciator located in the main engine room.

The thermostat system as installed on these vessels is very simple and is exceedingly reliable.

Those of us who have traveled much on steamers can appreciate the necessity of having a prompt and absolute means of communication between the navigating department and the engine room department on board a vessel. Thus far I have described the apparatus mainly for the comfort and convenience of the passenger, but now I come to the most important part of all—intercommunication between captain and chief engineer and the navigation of the vessel.

Telephones are now recognized as superior to speaking tubes, as these speaking tubes are usually long, have many bends, and the voice does not carry very well. The telephone, therefore, is preferred if it is of a good make and constructed to take care of the special loud-sounding requirements for shipboard.

On the Momus telephone communication is arranged between the pilot house, engine room, chief engineer's stateroom, and the warping bridge aft. Where the 'phones are exposed to weather conditions a watertight type of telephone was installed. This telephone is the same as is used in the United States navy practice. In the pilot house and in the chief engineer's stateroom non-watertight telephone sets are used. These telephones are all of the loud-sounding type and give excellent results in service.

The means of sending orders from the bridge to the engine room and a reply from the engine room to the bridge is commonly known on shipboard as a mechanical telegraph system. This system is divided into the following parts:

Engine telegraph.
Sounding telegraph.
Steering telegraph.
Anchor telegraph.
Docking telegraph.

The transmitting instrument of all the above systems, with one exception, is located on the bridge or in the pilot house, and orders are sent from the transmitters to the receivers located throughout the vessel.

These telegraph instruments are connected by wires to handles and indicating arrows in the instruments, and when a signal is sent by the transmitter an arrow points on the dial to the particular signal sent, and the reply is received back from the receiving station on the same dial by a reply arrow. Thus when the transmitting instrument shows that the two arrows are on the same indication, the captain understands that his orders have been understood.

These mechanical telegraphs are very important on vessels, and too much care cannot be exercised in installing them, for a failure of the apparatus when the vessel is in a tight place might mean an accident, such as a collision, etc.

A very convenient and useful piece of apparatus called the "electric whistle operator" is now installed on all vessels which have any pretensions whatever of being called up-to-date.

The operator consists of a valve operated by an electro-magnet, and it can also be operated by hand; a clockwork mechanism by which a contact is kept closed automatically for six seconds in every minute; a switch by which the valve is controlled from the bridge or other locations as may be desired. The magnet is placed in a watertight metal case alongside of the metal valve. The controlling switch for the bridge is of watertight construction and is adapted for mounting on a bulkhead or bridge rails. The movement of the switch lever to the first point gives a closed circuit for a continuous or at-will blast. For automatic signaling a clock mechanism mounted in a metal case and installed in the pilot house automatically closes the whistle valve for six seconds in every minute, and this signal is used when the vessel is under way in a fog.

The clock is an eight-day movement with practically all parts made of non-oxidizable metal, and you will note the binding posts located on a contact block alongside of the clock, and to these binding posts circuit wires are led from the whistle valve and the controlling switch on the bridge. Current is supplied for operating the whistle apparatus from the lighting mains at 110 volts.

These operators will work satisfactorily 20 volts above or 20 volts below the normal voltage, and the valve operates on full boiler pressure up to 300 pounds. All contact points are of platinum of ample size for continual service, and all breaks are of the double-pole type.

The apparatus is very simple and requires no other attention than to wind the clock once in eight days.

A Nicholson ship log is installed on the vessel and it is a radical departure from all other types of nautical measuring devices. In addition to giving the mileage sailed, it shows the speed per hour on a dial and records this speed on a paper record chart for every minute of the trip. These records can be dated and filed away for future reference, and should any accident or controversy occur they would furnish incontestable evidence.

When adjusted to the ship the log will run the distances as close as it is possible to steer the vessel, and will remain in adjustment an indefinite period if intelligent care is given to the apparatus. The whole apparatus s entirely automatic, and it requires very little attention beyond the daily winding of the clock and the changing of the paper records.

For taking soundings of the vessel there is installed a Kelvin deep sea sounding machine.

This completes the equipment directly connected with the navigating department of the vessel.

The necessity for having communication with the shore and with lightships when the vessel is at sea is recognized, and it is now the universal practice on all first-class vessels to install a wireless telegraph outfit, and as these vessels of the Southern Pacific Co. are thoroughly

up-to-date in every respect, special attention has been given to the installation of a wireless telegraph outfit, and this outfit was supplied by the American DeForest Wireless Telegraph Co., of New York.

In concluding this paper I desire to present for your consideration a few items which I feel may be of interest in connection with the elctrical outfit:

No. 1.	The total number of incandescent lights installed on the vessel is.....	900
No. 2.	The total number of thermostats for fire-detecting device is	160
No. 3.	The total number of push-buttons for the call-bell system is	160
No. 4.	The number of electric heaters installed is.....	175
No. 5.	The total weight of the electrical plant and means of interior communication is	48½ tons
No. 6.	The number of miles of copper wire in the electrical plant, including lighting, power, and heating systems, is	10½ miles
No. 7.	In the call-bell, thermostat, and telephone systems the number of miles of copper wire is	10
No. 8.	The amount of conduit installed on all systems is.	20,000 ft.
No. 9.	The total K. W. output of the generators under normal full load is.....	160 K. W.
No. 10.	The total connected K. W. load of electric heaters installed on the vessel is.	160 K. W.

From the above data you can appreciate that the electrical installation on board these vessels is of some magnitude, and we would necessarily expect to find at least a competent electrical mechanic devoted entirely to looking after this plant, but I regret to say that the whole plant is under the care of the chief engineer of the vessel, and there is no electrical man on board to look after the installation. I feel quite sure that in a plant of this magnitude on shore we would find a competent man devoted to taking care of it, but the particular point which I desire to bring out is that the ship building company performing the work of installing the electrical system must do their work in a very careful manner, and the work itself and the material used must be of the highest class. For on shore we have means at hand to enable us to make repairs, but on ship board, after the vessel is at sea, the facilities and the talent employed for such repairs are not always of the highest class.

I trust that I have been able to make you all better acquainted with the important part which electricity plays on the modern merchant marine vessel.

DISCUSSION.

E. M. Nichols—You spoke of having a sheet iron shield, at what distance above the heater? Was there any test made to find out how many heat units in steam delivered at the turbine were eeffctive at the heater? I would also like to ask a question concerning the heater. In how large a room was the heater installed? Granting that a 750-watt generator is supposed to be equal to 1 H. P., in steam heat that would mean 100 sq. ft. of heating surface, which will heat 20 rooms 6 x 8 ft.

Chas. J. Dougherty—The shield was placed about 2 in. above the heater; it is nothing more than a Russia iron shell, and turned over. In regard to the test you speak of, it has never been tried. The room in which the heater was installed is about 6 x 8 ft. We do not claim that electric heating is to be compared with steam heating; but our point is, that we have not the ugly coil of excess steam pipes that you have in your steam system, which are unsightly, and rather expensive at that. Our point is, that it is economical in the sense of space; it will not leak, and we cannot keep steam pipes from leaking on board ship. Then again we have carpets, and leaky steam pipes are apt to cause trouble where you have carpets.

Carl Hering—In connection with Mr. Nichols' criticism, namely, that the quantity of steam consumed to supply these electric heaters with current is greater than that used in direct steam heating, I desire to remark that if this steamer was intended for trips to the northern regions, where the heat would be likely to be turned on for 24 hours a day, instead of going to the southern regions, where it is likely that the heaters would be turned on only for a short time to take off the chill, electric heaters would probably not have been used. The great advantage of an electric heater, which should not be overlooked, is that you can get heat very quickly, and when you turn it off, there is absolutely no waste heat to be paid for, such as in the condensation in the network of steam pipes leading to a large number of individual steam heaters. The advantages of an electric heater are not in the amount of heat generated in the air of a room per pound of coal in the boiler, except under certain circumstances; the advantages lie chiefly in other directions, like convenience, absence of plumbing and its attending repairs, etc. They have been discussed so frequently that it is not necessary to repeat them here; I merely wish to emphasize that the efficiency in pounds of coal per square foot of heating surface is not necessarily a criterion, as there are many other considerations which also have a money value.

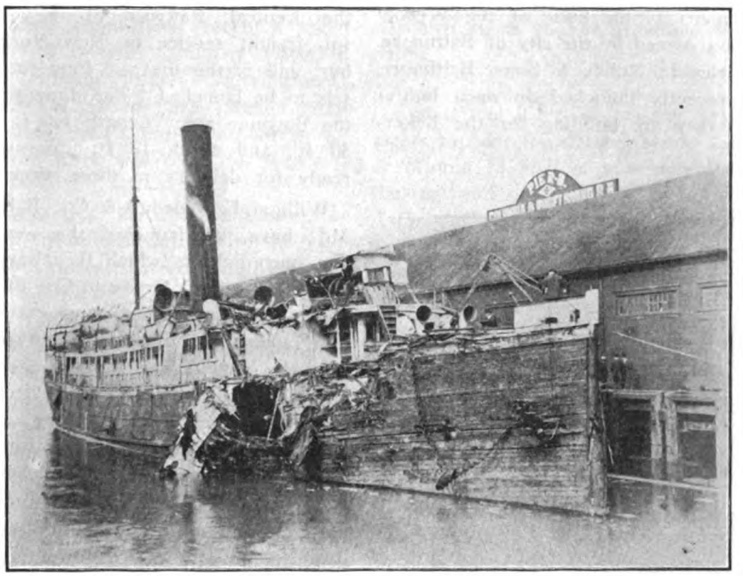
I do not know the reasons why the heaters in this case were made so small and heated to so high a temperature, but unless there are good reasons, it does not seem to me to be the best practice to heat the heaters to such a high temperature. The efficiency of the conversion of electric energy into heat energy in electric heaters is always 100 per cent. or virtually so, and therefore the only advantage I can see in using small heaters at high temperature, instead of larger ones at lower temperature, lies in the lower first cost. Against this, however, are the probably much more rapid deterioration, the danger of fire by the ignition of inflammable material in coming in contact with them, and the odor of burnt air. Without going into any calculations, it seems to me it would have been cheaper, in the end, had the heaters been made somewhat larger and were run at a lower temperature.

INDEPENDENT INSIDE VALVE DRIVE FOR RIVER STEAMBOAT ENGINES.

Gillett & Eaton, of Lake City, Minnesota, have recently brought out and are making application for patent on an independent inside valve drive, which they have gotten up particularly for the Gillett's balanced valve variable cut-off steamboat engines. This valve drive is applicable to other engines of the various types such as lever engines with California cut-off and other variable cut-offs. It is simplicity itself and absolutely reliable in every particular. The advantages in an arrangement of this kind will be readily appreciated by all engineers and steamboat owners, as it does entirely away with any connection with the wheel shaft whatever and therefore obviates any danger from broken or bent rods, danger from attending same out on the guards, and the extreme wear occasioned by sand and grit carried into the cams or eccentric's wearing parts. Being entirely inside it is very much more accessible and less dangerously cared for. This firm has recently brought out a catalog, the first of its kind pertaining particularly to river steamboat engines and machinery. The same may be had by making application to the above named firm.

WRECK OF COTTAGE CITY.

At 11:14 P. M., Friday, Oct. 16, the steamer Cottage City, of the Pacific Coast Steamship Co.'s Alaska fleet, and the lumber schooners Blakeley and Bainbridge, in tow of the tug Tyee, collided while off Jefferson Head, Puget Sound, 10 miles north of Seattle. The accident was one of the most destructive that has occurred this season on Puget Sound. The pilot house, forward cabins and entire starboard bow of the Cottage City were comletely demolished, her stem was badly sprung and the foremast was broken off flush with the deck; the Blakeley suffered such injuiries to her planking on both bows that she is leaking badly and also her jibboom and stem are split; the Bainbridge was scratched and her after rigging somewhat damaged. Repairs to the Cottage City will cost about $10,000, to the Blakeley about $3,000, and to the Bainbridge about $500; the total damage resulting from the collision is about $13,500. All the damage on the Cottage City is above the water line.



WRECK OF THE COTTAGE CITY.

The Cottage City is one of the best known boats on the Pacific coast and at one time ran between Seattle and San Francisco. She left Seattle Friday evening at 10 o'clock on her regular run to southeastern Alaska. The night was clear and on approaching the Tyee with her tow the customary passing signals were exchanged and understood. Immediately thereafter it seems that something went wrong with the steam steering gear on the Cottage City. Before she could be controlled she swung in close behind the Tyee, cut the tow line and collided with the Blakeley, the latter's jibboom raking her forward cabins. Then she swung off and rubbed against the Bainbridge. Apparently the accident was unavoidable.

Several persons were injured in the collision, including Capt. Jansen and Purser R. E. Jones of the Cottage City. Jones was in the water nearly half an hour and is badly hurt, but will recover. A steerage passenger, Frank Mattico, suffered a broken thigh.

CHANNEL TUNNEL FEASIBLE.

The attention of J. V. Davies, deputy chief engineer of the Hudson River Tunnel Companies, was called to the interview with W. E. Mandelick, secretary of the London Underground Railway Co., which appeared in some of the New York papers recently, concerning the possibility of tunneling the English chanel.

Mr. Davies said that he had read with much interest the interview with Mr. Mandelick in relation to a tunnel between the English and French coast, but that the work in no respect was comparable with the work under the Hudson river. He continued:

"As far as the public information goes, the channel tunnel has been located by its engineers on an indirect line so as to place it throughout in solid rock of the well known chalk formation which exists on both sides of the channel. Very thorough investigation has been made and it is generally believed that the tunnel throughout would be constructed in this rock.

"Tunneling under the Hudson river involves probably greater difficulties, which have been solved and under which the work was accomplished, than any piece of tunnel work ever undertaken. This work has largely been in Hudson river silt, but the great difficulties have been occasioned in the presence of a rock reef through which the tunnels have been constructed, partially in rock and partially in silt or sand overhead, and the engineering problem of carrying on this work through the formation has been probably more difficult than any other tunnel work which has ever been undertaken and all the difficulties have been successfully overcome.

"In relation to the English channel tunnel, it is a question largely of earning interest on the enormous expenditures which such an undertaking would necessitate. When this undertaking was first agitated it would have been practically impossible to have operated the tunnel even had it been completed, as no fuel burning engine could ever have passed through the enormous length of such a tunnel. In the present day, with electric power, and particularly if the east and westbound movement be separated, either in separate tunnels or by a partition wall, the traction problem is feasible and unquestionably the ventilation would be such as to insure safe operation.

"At the present time it does not seem that there is any adequate reason for the construction of this channel tunnel. It is difficult to imagine that any rate of fare could possibly earn sufficient income to pay the interest on such an enormous expenditure.

"The military aspect of the case would not prevent the construction of the channel tunnel for one minute if there was adequate advantage to be obtained by the two nations interested in having the construction carried out. The present means of conveyance is so simple and so rapid that there does not at the present time seem to be sufficient reason for its construction.

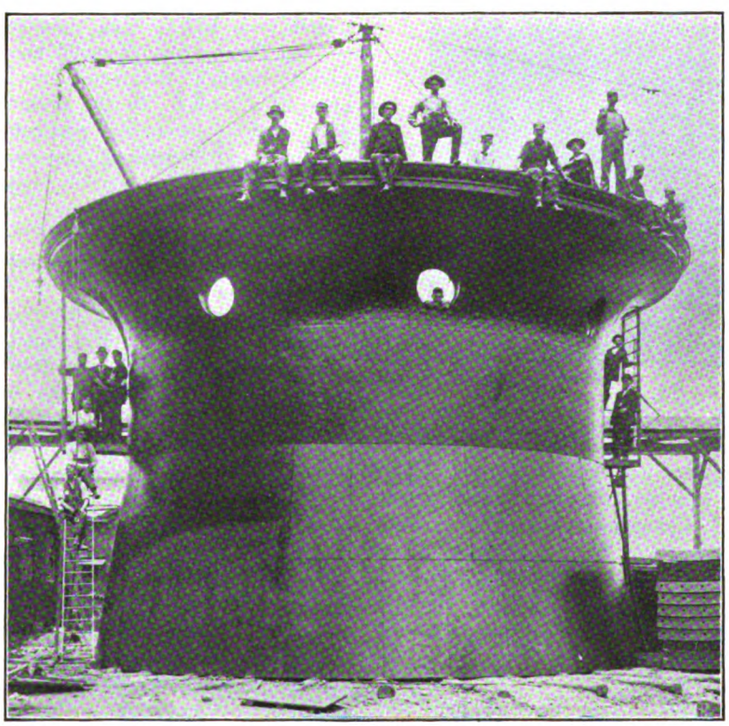
"Some day unquestionably this tunnel will be built and doubtless by the two nations interested advancing the money necessary. Undoubtedly the work of carrying out such an undertaking would require a great many years and would probably be interrupted many times before its consummation, so that those of us who are today interested in such a matter are not in the least likely to see its fulfillment."

The crew of the steamer John Sherwin was paid off last Saturday at Lorain and the steamer ordered to lay up at that port until further notice.

LIGHTHOUSE CONSTRUCTION.

The lighthouse under construction in the accompanying photograph is a type much in evidence on the Atlantic coast, and particularly in the New England territory. This style of sub-structure is built entirely of cast iron plating, cast iron being preferred as a material on account of its superior weather proof qualities. The plates are flanged inwardly and bolted together, a slight shoulder on the extreme edge of each flange (so that said shoulders on adjacent plates come in contact) forming a space into which suitable material may be calked. The interior is filled with concrete, the structure after completion being given a coat of paint composed of pure red lead and linseed oil.

The lighthouse shown, when completed, was erected at Delaware Bay, N. J., close to Wilmington, Del. The sub-structure is 42 ft. in height and 40 ft. 2 in. in diameter at the top. There are 294 plates with a total weight of 321,000 lb. The work of construction was commenced on Feb. 27 of this year and shipment made complete by June 27.



During the erection of the structure, which was built by the Lynchburg Foundry Co., of Lynchburg, Va., 15 plates (or 5 per cent of the total weight) were rejected by the inspectors. Considering the severity of the tests this is a highly creditable showing. This company has now under construction a superstructure, or lighthouse proper, for Makapuu Point light station, Oahn, Hawaii. There are 110 panes of plate glass, each 4 ft. 8 in. in length and 3 ft. 4 in. in breadth in the superstructure, about 13,000 lb. of bronze, wrought and cast iron bringing the total weight of the lighthouse up to 62,000 lb.

SHIP YARD NOTES.

The Spedden Ship Building Co.. Baltimore, Md., has been awarded contract for repairing the hull of the iceboat Latrobe, owned by the city of Baltimore.

Charles L. Rohde & Sons, Baltimore, Md., recently launched an open lighter which they are building for the Baker-Whitely Coal Co., of Baltimore. She is 90 ft. long, 28 ft. beam and 8½ ft. deep and is to be used in transporting coal in the harbor.

The Stamford Co., Stamford, Conn., is about to launch a 75-ft. cruising power yacht for Merrill B. Mills, of Detroit. Mich. The yacht will be used in Florida waters. A sister yacht is also building at this yard for E. B. Hawkins, of Duluth, Minn., which will be ready for delivery in two or three weeks.

The Skinner Ship Building Co., Baltimore, Md., was the successful bidder for making repairs and overhauling the United Fruit Co.'s steamer Brookline, which like her sister ship the Barnstable, is being prepared for the winter passenger trade with Jamaica.

The Maryland Steel Co., Sparrow's Point, Md., has laid the keels of the three colliers which it is to build for the United States navy. Work on the bottom plating has now been begun and the machinery for the three vessels is progressing rapidly at the company's machine shops.

Harlan & Hollingsworth Corp., Wilmington, Del., launched the steam lighter Bayonne Oct. 29. She is building for the Central Railway of New Jersey for freight service in New York harbor, and is the first of four such vessels to be launched. The dimensions of the Bayonne are: Length 110 ft., beam 30 ft., and depth 12 ft. She will be ready for delivery in three weeks.

William E. Woodall & Co., Baltimore, Md., have just launched the second of two open lighters which they have built for the Southern Products Co., of Baltimore, to be used in towing garbage to that company's disposal plant on the Magothy river. The lighters are 80 ft. long, 24 ft. beam and 7½ ft. deep. Immediately after the launching of this lighter the blocks were raised for a duplicate which the company will build for stock.

The contract for furnishing the navy department with 10 torpedo boat destroyers under bids opened Sept. 1 has been divided among five companies, each of which will construct two of these vessels. The concerns are: Bath Iron Works, Bath, Me., Fore River Ship Building Co., Quincy, Mass., New York Ship Building Co., Camden, N. J., William Cramp & Sons Ship & Engine Building Co., Philadelphia, Pa., and the Newport News Ship Building & Dry Dock Co., Newport News, Va. With the exception of the Fore River and Cramp awards the plans to be followed in building these craft are those furnished by the navy department.

The Spedden Ship Building Co., Baltimore, Md., has the Diamond Shoal Lightship No. 71 at its yard for repairs. Nearly all her galvanized iron bolts have been eaten through by something, but the exact cause is puzzling the lighthouse officials to determine. Three theories have been advanced, galvanic action, resulting from the effect of the copper sheathing, the salt water and the iron; electrolytic action from the presence in the frame work of the ship of electric currents from her dynamo, or the presence of acid in the wood of the vessel.

PACIFIC COAST NOTES.

Office of the MARINE REVIEW,
302 Pioneer Bldg., Seattle, Wash., Oct. 30.

The Moran Co., Seattle, has been awarded the contract for the repair of the steamer Cottage City for a consideration of $26,230, with a time limit of 36 days. Other bids were as follows: Hall Bros., Marine Railway & Ship Building Co., $27,500, 45 days; Heffernan Engine Works, $34,400, 45 days. The contract was awarded in San Francisco by George Higbee, general manager of the Pacific Coast Steamship Co. The work includes practically rebuilding the starboard bow of the Cottage City. The Moran Co. is also the lowest bidder on two large dredges for which the Isthmain canal commission recently asked tenders. The local company underbid all the Atlantic firms. No announcement of the awards has come from Washington but if the lowest bid is accepted the work will come to Seattle.

Tuesday, Oct. 27, the Canadian Pacific railway advanced the fare on their steamers Princess Victoria and Princess Charlotte between Victoria and Seattle from 25 cents to $2, the round trip rate being $3.50 with a special week end rate of $2. These were the rates of fare before the beginning of the long and bitter rate war that has been waged for nearly six months between the C. P. R. and the Puget Sound Navigation Co. While the raise in fare virtually amounts to a capitulation by the Canadian line the Puget Sound Navigation Co. will maintain the low rate of 25 cents. Officials of the American line express themselves as satisfied both with the schedule and the low rate.

With her crew almost overcome by battling with an ocean gale, a large part of a valuable deck load of mining timbers lost at sea, and with rigging wrenched and sails torn the American schooner J. B. Lunsmann, Capt. August Anderson, was forced to return to shelter at Port Townsend, Oct. 26. For seven days the Lunsmann all but foundered off Cape Flattery and was finally picked up and assisted by the tug Wyadda. Without her load of lumber she would surely have gone down.

The West Seattle ferry and the tug Ruth collided recently in a fog in Elliot Bay. The Ruth sustained a broken stem and had a large section of her rail torn out. The ferry was not damaged.

Dec. 5, the new navy collier Prometheus will be launched at the Mare Island navy yard, San Francisco. She is one of the largest steel steamships ever built on the Pacific coast. Her principal dimensions are as follows: Length over all, 485 ft. 9 in.; extreme breadth, 60 ft. 2½ in.; displacement at mean low draft, 12,500 tons; dead weight capacity, 6,500 tons; bunker capacity, 1,575 tons; engines twin screw, vertical, triple expansion; complement, 19 officers, 214 men.

Capt. E. C. Genereaux, of Seattle, surveyor for the San Francisco board of underwriters, announces that the attempt to save the steamer Bandon, which struck Tillamook bar, Oregon, Oct. 3, and was beached has been successful. The Bandon will proceed under her own steam to San Francisco for repairs.

Capt. Dan Kern is making arrangements to raise the derelict steam schooner Minnie E. Kelton, now marooned at the east end of the O. R. & N. pier at Astoria, Ore. When raised she will be beached at Tongue Point, examined and probably taken to San Francisco for repairs.

The Heffernan dry dock at Quartermaster Harbor is to be lengthened 60 ft., so it can accommodate vessels 420 ft. in length. It will take some time to complete the addition but when it is done the capacity of the dock will be greatly increased.

C. D. Hillman, of Seattle, has purchased the side wheel excursion steamer Yosemite, the consideration being $75,000. Although the Yosemite is 38 years old she is said to be still in good condition.

The underwriters have practically decided to abandon the steamship Aeon which was wrecked several weeks ago on a reef off Christmas Island. The steamer is in such shape and position that she cannot be saved without the expenditure of an unwarranted amount of money.

The Willamete Iron & Steel Works, Portland, reports that the work on the two government artillery tenders which it is building is progressing rapidly and that the vessels are about 25 per cent completed. The steel passenger steamer H. B. Kennedy, which the same company is building for the Port Orchard route, Seattle, is nearly finished and will be launched about Nov. 11. Miss Minna Benbennisk will probably be sponsor for the Kennedy at the launching, having been chosen by popular vote by the residents of Port Orchard Bay.

NEW DREDGER FOR NEW ZEALAND.

There was launched from the works of William Simons & Co., Ltd., Renfrew, on Sept. 30, the Mawhera, one of their latest type of twin-screw stern-well combined bucket, suction, and discharging dredgers. The vessel, which has been built to the order of the harbor board of Greymouth, New Zealand, was launched with all its machinery on board complete ready for work. The hull and machinery have been built to Lloyds highest class, and the bucket and pump-dredging outfit embodies all the most modern improvements. The vessel is also supplied with all the appliances necessary for reclaiming land. The bucket ladder is so arranged that the bucket can dredge close up to quay walls, and also cut out the dredger's own flotation. The discharging pump is arranged to receive and deliver through a long length of floating and shore pipes, the material dredged by the suction pump or by the buckets. The propelling power of the vessel consists of two sets of triple-expansion surface-condensing engines, each driving its own propeller. Steam is supplied by two steel boilers constructed to Lloyds and board of trade requirements for a working pressure of 160 lb. The engine room auxiliary outfit includes independent automatic feed pumps, bilge pumps, service pumps, circulating pumps, condenser, feed heater, and filter. The propelling engines are also arranged for driving the bucket chain at two different speeds, and the suction pump and discharging pump, either in conjunction with the buckets or separately. The dredging machinery is of very massive design for dealing with hard material, and all parts of the gearing and bucket chain are of special hard and durable steel, so as to reduce wear and tear to a minimum. Independent steam hoist gears are provided both for ladder and suction pipe. The mooring winches at the bow and stern are of exceptional strength. The dredger, which was named Mawhera by Miss Wilhelmina Brown, of Kilrene, youngest daughter of William Brown, chairman of William Brown & Co., Ltd., has been constructed under the supervision of Harry Raymond, inspecting engineer to the Greymouth harbor board, New Zealand.

An obsolete British battleship, the Colossus, has been sold for breaking-up purposes for the sum of $92,500.

THE MARINE REVIEW

DEVOTED TO EVERYTHING AND EVERY INTEREST CONNECTED OR ASSOCIATED WITH MARINE MATTERS ON THE FACE OF THE EARTH.

Published every Thursday by

The Penton Publishing Co.
CLEVELAND.

BOSTON.....73-74 Journal Bldg.
BUFFALO.....932 Ellicott Sq.
CHICAGO.....1328 Monadnock Blk.
CINCINNATI.....First National Bank Bldg.
NEW YORK.....1005 West Street Bldg.
PITTSBURG.....510 Park Bldg.
SEATTLE.....302 Pioneer Bldg.

Correspondence on Marine Engineering, Ship Building and Shipping Subjects Solicited.

Subscription, U. S. and Mexico, $3.00 per annum. Canada, $4.00. Foreign, $4.50. Subscribers can have addresses changed at will.

Change of advertising copy must reach this office on Thursday preceding date of publication.

The Cleveland News Co. will supply the trade with the MARINE REVIEW through the regular channels of the American News Co.

European Agents, The International News Company, Breams Building, Chancery Lane, London, E. C., England.

Entered at the Post Office at Cleveland, Ohio, as Second Class Matter.

November 5, 1908.

AT DUTY'S CALL.

At the investigation following the sinking of the steamer Cramlington through collision with the steamer Kirby, off Spurn Head, last month, several incidents of considerable interest came to light. Not the least of these was the report of the Cramlington's engineer, who, with three firemen, remained below to keep up steam. The three firemen stuck to their posts till the inrushing sea flooded the foot plates in the boiler room, when they were ordered up the ladder. The engineer followed them when he had decided that further efforts on his part would be of no avail, the sea having extinguished the fires. Another investigation, this time into the loss of a passenger steamer through grounding in thick and heavy weather, disclosed the fact that the engineer at the levers "rang off" the telegraph and climbed the ladder when the cranks were submerged and the ship resting at a dangerous angle. And these are only two instances of the engineer's sense of duty and responsibility in the face of danger.

When it is taken into consideration that the engineer is cut off from all communication with the outer world—with the exception of the bridge telegraph, of course—sticking to his post till such times as his services below are no longer of use, is all the more commendable. The desire to know just what is transpiring on the deck overhead is strong within him, but must be overcome. His main desire is to know what is transpiring in the sections of engine and boiler rooms away from his sight and hearing. The electric lights diminish until nothing but a dimly glowing thread shows in the bulbs, flicker and die out, throwing the engine room in utter darkness, save where an emergency oil lamp is burning fitfully in the vapor-laden atmosphere. Gigantic seas break over the upper decks and come tumbling down through the skylights, plunging from the cylinder heads, crashing through the gratings to the foot plates, where the engineer is hanging to the levers and mopping the hot salt water from his face.

The wash of water around the flooded engine room brings an extraordinary accumulation of matter to the bilge strainers, and the pumps alternately choke and race. The reports on the condition of the flooded bilges, the activity of the auxiliary machinery, and the amount of water in the boilers all vary according to the mental condition of the attendants, but the engineer can only know it and hope for the best.

A young engineer had, several years ago, chosen the worst season of the year to make his maiden voyage—midwinter. The ship was one of these large and capacious craft designed for the freight and emigrant trade, propelled by twin engines. On the occasion mentioned the vessel encountered unusually heavy weather, so much so that a considerable part of the deck gear was smashed or carried away. There were no bilge keels on the vessel and her progress, according to the young engineer, was appalling to behold. One night, when the gale was at its worst, a violent lurch shook the big ship right down to her bilge, a tremendous sea swept down through the skylights—which were open on account of the high temperature below—and flooded the engine room. A second or so later the telegraphs from the bridge rang "Stop," and our friend shut both engines down, but not before the second engineer had slid with lightning rapidity down the swaying ladder from the deck. He relieved our friend at the levers, sending him into the boiler rooms.

Simultaneous with the arrival of the young engineer at his post another sea crashed down through the fiddeleys and flooded the boiler rooms. In doing so the cold sea water came in contact with the water gage glasses, with the result that they exploded, flooding the boiler rooms with vapor. The foot plates awash, the darkness—the dynamos were also temporarily out of business—and roar of escaping steam proved too much for some green hands in the fire room, who bolted headlong into the engine room and charged for the ladder. They were foiled in their purpose, however, as the second engineer managed to grip the leader by an ankle and yank him back down the ladder. A carelessly-placed but forceful kick sent the second man staggering back through the boiler room door, and the others precipitately followed him.

On investigation it developed that the steering gear had broken down, and the swinging round of the ship into the seaway had caused the heavy rolling and shipping of seas. Later, when things were once more to rights and the ship again under way, the young engineer admiringly spoke of the second engineer's masterful manner of handling a panic-stricken crew. His senior laughingly passed the incident off, but grasped the opportunity of giving a little never-to-be-forgotten advice.

"When I came below," said the second, "the alleyways were packed with half-crazy emigrants, all yelling, praying and generally excited. You can imagine the effect on that crowd if a half dozen scared figures had suddenly darted out of the engine room door. You see, we have to think of all these little things. Ignorance of the law is no excuse ashore, and an engineer's ignorance of his responsibilities is no excuse afloat or ashore. You acquire a sense of responsibility with your knowledge of your duties, and must think first, last and all the time of what is depending on your nerve and grasp of detail."

And this piece of advice covers the whole situation.

NOW A SHIPPING BILL.

Well, the election is over, and everybody is breathing easier, feeling, whether well founded or not, that a national danger has been averted. William H. Taft is to be the next president and his policies are already well defined. One of the conspicuous planks of the Republican platform was a definite promise to rehabilitate the American merchant marine. No man is better aware of the necessity for this rehabilitation than Mr. Taft, whose work during the past 10 years has been cast in lines intimately associated with our oversea marine. He knows the necessity for ships. He will have the support of a congress favorable to American shipping, and one of his earliest duties should be the furthering of legislation to this end. The nation expects its representatives to uphold the platform upon which they were elected.

PIG IRON SITUATION.

The decided improvement which characterized the pig iron market within the past few days indicates, it is believed, a permanent change for the better. The atmosphere has been cleared by the presidential election, and moderate buying in all lines began Wednesday morning by telegraph. The largest producer received orders and specifications for 25,000 tons of steel bars in October, and other manufacturers of steel bars are steadily receiving specifications, with numerous promises of orders and specifications to follow election. Pig iron transactions made within a very few days include over 100,000 tons, besides numerous inquiries for tonnages varying from 2,500 to 25,000 tons of all grades of pig iron. A noticeable strength in prices is a tendency, and it is anticipated that advances may soon be announced. Railroads are showing an active disposition to buy, and specifications have been received within a day or so for 17,000 tons of rails, while large orders for the repairing of passenger and freight cars, as well as steel for bridge building, have been placed. The volume of new business in structural material is very large. Drouth still interferes with operations in the coke regions, but prices are firm. Furnaces and foundries show more disposition to contract.

LAKE FREIGHT SITUATION.

Excepting fog, weather conditions during October were ideal, and the ore movement was the heaviest for any month of the present season, the movement being 5,099,110 tons, making a total movement to Nov. 1 of 21,730,070 tons. It will be therefore easy to bring the total movement for the season up to 25,000,000 tons. A number of independent vessels are securing winter quarters, but the leading shippers will operate their own fleets during the whole of November. Altogether the feeling in the trade is better. Coal is moving more freely, but the grain trade continues unattractive.

MEETING OF PASSENGER LINES.

The American Association of Passenger Steamboat Men held a meeting at Boston on Thursday, Nov. 5, to protest against the ruling of the interstate commerce commission which requires all steamboat lines doing an interstate business to file a schedule of freight and passenger tariffs which cannot be exchanged without 30 days' notice. Obviously any one who understands how the steamship business of the country is transacted will appreciate how great an injury such a ruling would be to an established line. There is no necessity for it whatever, as everyone knows that rates for transportation by water in this country are very low. As far as is known no one has ever complained of them.

BUSY TIME FOR FAVORITE.

The wrecker Favorite has had a busy time of it lately. She succeeded in pulling the steamer Walter Vail off Round Island and the Vail went off St. Ignace for repairs. The Favorite then began work upon the schooner Connelly Bros., consort of the Vail, and after releasing her, towed her to St. Ignace. Both the Vail and Connelly Bros. were loaded with lumber. The steamer Canadian, which had been on the rocks near Detour for over a week was also released. This vessel was in an exceedingly bad position, her bow being in 6 ft. of water and her stern in 20 ft., with rocks all around her. The greater part of her cargo of package freight had to be lightered before she could be released. Her forepeak and No. 1 and 2 tanks were full of water and there was a bad leak under her boilers. The Favorite installed one of her pumps aboard her as well as a boiler.

QUARTERLY STEEL FIGURES.

The directors of the United States Steel Corporation recently declared the regular quarterly dividends of ½ of 1 per cent on the common and 1¾ per cent on the preferred stocks. The net earnings for the three months ended Sept. 30, compare as follows:

Quarter Ended—			Unfilled Tonnage.	Net Earnings.
Sept.	30,	1908.....	3,421,977	$27,106,274
June	30,	1908.....	3,313,876	20,265,756
Mar.	31,	1908.....	3,765,343	18,220,005
Dec.	31,	1907.....	4,642,553	32,553,995
Sept.	31,	1907.....	6,425,008	43,804,285
June	30,	1907.....	7,603,878	45,503,705
Mar.	31,	1907.....	8,043,858	39,122,492
Dec.	31,	1906.....	8,489,718	41,750,125
Sept.	30,	1906.....	7,936,884	38,114,624
June	30,	1906.....	6,809,589	40,125,032
Mar.	31,	1906.....	7,018,712	36,634,490
Dec.	31,	1905.....	7,605,086	35,216,066
Sept.	30,	1905.....	5,865,377	31,240,582
June	30,	1905.....	4,829,655	30,305,116
Mar.	31,	1905.....	5,579,560	23,025,895
Dec.	31,	1904.....	4,696,203	21,466,203
Sept.	30,	1904.....	3,027,436	18,773,932
June	30,	1904.....	3,192,277	19,490,725
Mar.	31,	1904.....	4,136,691	13,445,231
Dec.	31,	1903.....	3,215,123	15,037,181
Sept.	30,	1903.....	3,278,742	32,422,954
June	30,	1903.....	4,666,578	36,642,308
Mar.	31,	1903.....	5,410,719	25,068,707
Dec.	31,	1902.....	5,347,523	31,985,759
Sept.	30,	1902.....	4,843,007	36,945,488
June	30,	1902.....	4,791,993	37,662,058

All the necessary land for the making of a turning basin in the Kinnickinnic river at Milwaukee has now been condemned and deeds of title transferred to Major Judson, government engineer, by the city of Milwaukee. Money for the construction of this basin was appropriated by congress over a year ago. The basin is to be located between Clinton and Becher streets and is to be 650 ft. in diameter.

The steamer Peshtigo, which stranded on Mission Point, Mackinac Island, has been pounded pretty hard by the heavy seas since she went on and is reported to be practically broken in two. She has been abandoned.

Holmes' Tube Tanker---A New Form of Construction for Tank Steamers Carrying Petroleum in Bulk.

BY SAMUEL HOLMES.

Is the structural design of the present day tank steamer for carrying petroleum in bulk the most mechanical, efficient and economical type of vessel for the service that can be built?

To this query we answer no! and being impressed with the mechanical imperfections of the present system of construction, we will discuss it and propose a substitute that is mechanical and economical and that costs less to build and to keep up, and by the improved design enables us to increase the length of the ship to 600 ft. without increasing thereby the load draught of water over 23 ft.

Bulk oil being a homogeneous liquid cargo, a vessel will not carry herself full, therefore in the construction of a tank steamer it is necessary to reduce the internal capacity of the vessel, that the holds when loaded may be full, that the center of gravity of cargo may be as low as possible to insure safety from capsizing, and that the cargo may be spread as far fore and aft as possible to avoid it being bunched within a too comparatively short fore and aft distance amidships, leaving long distances at the ends of the vessel empty, thus establishing a serious cause for excessive straining. To accomplish the incorporation of these three attributes in the hull of a steamer is the origin of the present design of the tank steamship.

A suitable and happy point for the oil cargo to taper off, is where the section of the vessel ceases to be water borne, because all weight passing this point causes strain.

We do not mention this as a practical fault or objection, it is a natural result which all vessels are structurally fully able to disregard; we only name it because the oil cargo has to stop short of the vessel's ends at some section, and this marks a suitable point for the reason stated.

In accomplishing this necessity of carrying a homogeneous cargo of oil, to prevent the bunching of cargo, and a dangerously high center of gravity of cargo, with its possibility of causing the vessel to capsize, arises the constructive principle that suggests our subject—an alteration in tank steamer construction.

We do not think it necessary to give consideration in applying the principle of reducing the vessel's internal capacity to regard a reduction of free surface as compulsory. Our experience establishes the opinion that it can be eliminated. Were it not for the objectionable feature of carrying an entire cargo over only a portion of the vessel's length amidships, and thus concentrating the weight unduly in the center of the vessel's length, there is little reason, as far as necessity goes, to reduce free surface. The small item of oil expansion can be taken care of in area of hatches with deep coamings.

We thus clear the way to discuss the method that seems almost universally and permanently adopted, to constructively reduce capacity and establish reduced free surface, to which point of construction of present day tank steamers we take exception and shall endeavor to establish what appeals to us as being more mechanical in constructive form, and adds the advantages of structural strength, reduction of weight, reduction in cost of construction, reduction in cost of maintenance and repairs, and increases a ship's earning capacity by carrying the saving in weight of structure in additional cargo.

We advance mechanically so conservatively that to speak of a tank steamer without an expansion trunk will seem like sacrilege, yet it must come. For 20 years or more this expansion trunk has been repeated in vessel after vessel that the wonder is it hasn't been torn to pieces long ago by criticism.

The expansion trunk is formed by cutting out sufficient space of the vessel's oil carrying capacity in the shape of a square or rectangular area, forming an alley-way at each side of the vessel under the upper deck, extending athwartships from the side of the trunk to the side of the ship, at each side of the vessel. This vacant space at each side has necessarily to be made oil tight, and being flat-sided, these flat surfaces against which the oil cargo presses have to be reinforced like bulkheads with heavy channel bars and knees and all the accompanying stiffening that a flat surface under pressure (and a varying pressure at that) requires. As fitted, these flat sides must be unyielding to the pressure of the cargo of oil constantly against them on one side, and being flat, there is no strength from shape, such as a curve gives, or support from balance of fluid. It is the sheer strength of added material, best illustrated as being of the order of the house that Jack built, every addition to make this flat side, requires another addition to hold it together.

Could it be shown that these reinforced flat surfaces, besides making the oil cargo tank tight, or, in other words, making it an oil tank, added structured strength to the hull, from a ship builder's point of view, some excuse might exist for the system of construction adopted; but such added structural strength does not exist, because as a girder, to give longitudinal strength, the proportions and scantling of a useful girder are missing, and all that such a structure can do, in the way of added strength of hull, when extended to the bottom of the vessel through the agency of pillars, is to extend the use of a pillar to the upper deck, whereby the upper deck gets some support and that is all.

Again a similar criticism applies to the flat of deck, which extends from the bottom of the trunk side to the side of ship. It is another flat surface to be strengthened, to make a flat surface strong enough, and like all such flat surfaces, if not rigid, leaking rivets will soon appear.

The crowning fault of this construction, however, is exemplified in the connection between the deck and the ship's side. This flat surface construction makes it necessary to cut the ship's frame, and after it is cut to mend it. It is necessary to cut the frame, to attach the stringer plate to the shell by a continuous fore and aft angle, to get a clear calking edge on each flange to make the connection oil tight. The ship's frame, which must be cut to lodge this angle bar in position, has then to be reattached by knees with flangers or angles in the same extravagant, weight adding, labor and expense adding, system as before described.

I feel convinced that ship builders will follow my remarks with interest and sympathy when I declaim against cutting and mending, against adopting flat surfaces requiring the additional weight of material and labor necessary for reinforcing the same, and I also think from their independence of thought and experience, when

their attention is drawn to this ridiculous construction, they will be prepared for suggestions of special utility recognizing the room that exists for a change.

The oil tank steamship of the present day should be a single-decked vessel. It should be a vessel of light draught. The draught should not exceed 23 ft. I am fixing this draught from the standpoint of economy. No tank steamship should exclude itself by reason of too deep draught of water, from the Texas ports of Sabine Pass and Port Arthur, and the point of economy excludes a steamship hauling out into a fairway to complete loading by barge alongside, because of lack of water at the dock.

The oil tank steamship has now closely approached a ship of 500 ft. in length, and there is no reason why we should stop at 500 ft., although we stop at a draught of 23 ft.

These conditions call for a ship of superior construction, but they do not make the necessity for a superior construction; that necessity already exists.

The oil tank steamer of today should be as closely allied to an ordinary steamer as possible, so that, if desirable to convert her into an ordinary cargo steamer, the pulling to pieces may be as small as possible, and the necessary alterations will be in the shape of additions which have not already been paid for, but when added are paid for for the first time.

Before describing the proposed tank steamship, I have thus sketched what the present day requires.

I need not repeat the requirements of extending the cargo as far toward the ends of the ship as practicable.

It is necessary as explained to cut out a certain portion of the cargo space, and I propose doing this by constructing a tube at each side of the vessel underneath the deck beams, as shown in Fig. 2. These tubes will take the place of the square alleyways at the sides of the expansion trunk, so-called, as shown in Fig. 1. These tubes will be in size, governed by the requirements of extending the cargo sufficiently fore and aft.

The structural efficiency of these tubes I think will be apparent. In the first place they are surrounded by the oil cargo, consequently no reinforcing need be provided to give strength. A perfect balance is established by the oil cargo, so that the conditions existing in the tankers with the flat surface alleyways, with the cargo thrusting only on one side and requiring extraordinary stiffening to resist the pressure, does not exist in this new proposition.

I must emphasize this quality of balance, as it represents by comparison with the flat surface system a saving of many tons of material and labor. Balance costs nothing, while unbalanced force costs material and labor and reduced carrying capacity. Balance tends to endurance, while unbalanced force tends to destruction, and increases the cost of repairs. Balance is a law of nature, the non-use of it, when available, is a mechanical sin.

The wing tubes I propose leading fore and aft through the bulkheads with shifted butts to retain the continuity of strength. They will relieve the bulkheads of considerable weight of material that is cut out of them, and as an angle collar attaches them to the bulkheads they will diffuse through the bulkheads immense additional strength.

The wing tubes are carried in the concave of knees which effectually tie the deck and the sides of the ship together. The weakest spot in all ships is at the gunwale. Wherever there is any straining of the vessel, you will discover its effect at the beam knees. These large knees are a feature of great strength to the vessel, and through them the tubes are made an efficient part of the mechanical structure, by being worked into the structure.

The wing tubes thus give longitudinal strength in such a marked degree that they enable us to build a 600-ft. tank steamer on a molded depth of vessel only necessary for 23-ft. draught.

The present system of tank steamer construction will not permit this. A tank steamer of 600 ft. length would of necessity have a considerable increase in her depth molded above the requirements for 23 ft. draught of water, making the vessel cost proportionately.

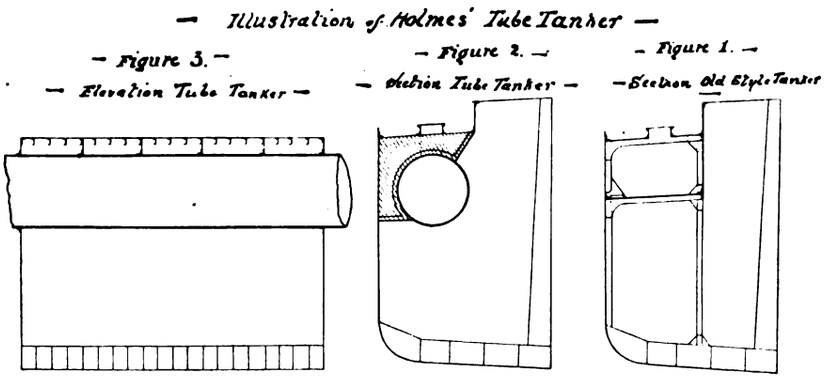
By the adoption of the new construction, the frame of the vessel is not cut. When the frame is once bent and erected in position it is finished. No more expense attaches to it, and no more weight and expense is added by cutting and splicing, as the old construction requires.

The large beam knees dispense with the necessity of web frames when channel frames are used. They also dispense with the necessity for pillars. The spacing of these knees depends upon the length of vessel and diameter of tubes. The longer the vessel the closer the spacing.

It is the purpose of this design that these seating knees for the tubes shall extend half around the tubes and be thoroughly attached to the deck beams and to the ship's frame. We can, therefore, with pleasure draw your special attention to this mechanical combination at the weakest part of all ships, for this element of strength, introduced at this point, makes the gunwale as strong as the bilge.

It is proper to also call your attention to the fact that in carrying out this work, the tubes can be built upon the ground, and would be all template work, so that in construction the work is of the cheapest character to execute, and when riveted in position there are no hiding places for rust and corruption, because a paint brush can follow all around the tube; in fact, a man can pass between the tube and the deck, and between the tube and the ship's side, all is clear for the entire circle. We encourage a straight tube and a comparatively straight deck line.

To summarize the principal advantages of this new construction I prefer according first place to the beautiful balance the form of structure enables the liquid cargo to establish;



thus making it possible to embrace maximum strength with minimum weight.

Secondly, the tube or circular alleyway is so thoroughly incorporated into the vessel's structure that it imparts immense additional strength to hull.

This strength is so greatly increased by the addition of the two tubes that a 600-ft. tank steamer can be constructed upon this principle without any greater depth of hold than is necessary for a vessel 23 ft. draught of water and allowing the usual freeboard.

Thirdly, maximum strength with minimum weight means cheapness of construction and economy in service.

Fig. 1 represents a section of vessel showing the present square alleyway.

Fig. 2 represents a section of vessel showing the proposed tube alleyway.

Fig. 3 represents an elevation, showing the proposed tube alleyway.

As I have not attempted an exhaustive paper, but have sought to express the main features of a new form of construction for tank steamers carrying petroleum in bulk, I omit referring to many details that might carry the subject to undue length.

ATLANTIC COAST NOTES.

Office of the MARINE REVIEW,
Room 1005, No. 90 West St.,
New York City.

Incoming Atlantic liners are reporting unusually heavy weather encountered on the voyage.

The Kaiserin Auguste Victoria, of the Hamburg-American Line, has sailed for the United States with 1,054 emigrants. On one day recently six liners arrived at New York with a total of 2,623 immigrants. It is pointed out that this increase of immigrant traffic is a sure sign of returning prosperity.

Two new bulk oil carriers are on thir way to Philadelphia from British shipyards. The Tamarac, built for the Anglo-American Oil Co., hails from Glasgow and registers 5,263 tons. The Petroleine is of 4,230 tons, and is owned by the Saxoleine Steamship Co. Thy have both been built with all modern improvements.

The Clyde Steamship Co. this week increases its sailings between New York, Charleston and Jacksonville. Steamers will now leave New York on Tuesdays, Wednesday, Fridays and Saturdays, and will leave Jacksonville Sundays, Mondays, Wednesdays and Fridays. Vessels will stop at Charleston, S. C., coming and going.

The Danish steamship Granaria has been chartered to load a cargo of wheat at Philadelphia, for the Mediterranean. The exports of wheat from Philadelphia show a gain, but the corn is now several million bushels behind last year.

The new United States hydraulic dredge Clatsop, recently built at Sparrow's Point for use on the Pacific, and which has been at work in the lower Delaware Bay, is to be fitted out this week at Philadelphia for her long voyage to Seattle, where she will be permanently stationed.

Capt. Chisholm, of the steamer Georgetown, of the Atlantic Coast Lumber Co., which arrived at Norfolk recently, reports the sighting of an unknown submerged vessel with three masts protruding above the water, when 17 miles south of Frying Pan Shoals Lightship, N. C. The name of the vessel is not known.

Fire broke out on the steamship S. V. Luckenbach, of the Insular Line, while she was off Hatteras last week. The Red D Line steamship Philadelphia, also bound from New York to Porto Rico, stood by the Luckenbach until the fire was under control, after which she sent a wireless message to the agents of the Luckenbach at New York.

Hartfield, Solari & Co., agents of La Veloce Line, have received a cable announcing the successful launching of its new twin screw steamer America, which took place at the Mugiano ship yards at Spezia, Italy. The new vessel is of 12,000 tons displacement, is over 500 feet in length and has been specially constructed for passenger traffic between Genoa, Naples and New York. She will accommodate about 100 first class passengers, 70 second class and 2,000 steerage.

The launching of the New North German Lloyd steamer George Washington, which was to have taken place on Saturday at the suburb of Stettin, Germany, has been postponed indefinitely on account of the low water in the river Oder. David Jayne Hill, the American ambassador, was to have christened the vessel.

Coal freights to domestic ports are firm, and there is an advance over the low rates which have prevailed for many months. For the West Indies trade rates are steady, with a limited supply of tonnage for early loading. Barges for down east ports are being chartered at better rates, the barge E. W. Stetson, of Philadelphia, having recently been closed to load 1,250 tons of coal for Boston at 70 cents per ton.

Cablegrams from the Azore Islands state that the Italian bark Ines, from Stockton Springs, Me., for Palermo, was abandoned off St. Mary's Island on Oct. 28. She was leaking badly and her pumps were disabled. The crew were landed at St. Michaels.

The first schooner to be fitted with wireless telegraphy is the Pendleton Sisters, which has just arrived at Portland from Baltimore. Her owners during the entire voyage were kept informed of her whereabouts, the first message being sent from Delaware breakwater.

The schooner American Team, bound from Maine to New York, was towed into New Haven on Saturday night by the steamer Bunker Hill. The American Team sprang a leak in Long Island Sound and was only kept afloat by her cargo of lumber.

The tug Redwing, owned by the Coastwise Dredging Co., of Norfolk, caught fire and burned to the water's edge at Brunswick on Saturday night. The tug was engaged in attending the company's dredges at work off Brunswick harbor, and the origin of the fire is unknown.

The steamer Delaware, bound for New York from Philadelphia, on Oct. 30, off Long Branch, sighted the schooner Jennie S. Hall, from Savannah for Boston in distress. She was short of provisions and was supplied.

Capt. J. B. Watt, the veteran commander of the Cunard liner Lusitania, has practically completed his active career at sea. His resignation will take effect on his arrival at Liverpool. Capt. Watt, last week at New York, gave his daughter's hand in marriage to a fourth cousin of the bride. His daughter accompanied him on his last westbound trip.

The German steamship Energie, which arrived at New York in ballast from Shields, and was unable to secure a cargo of petroleum at that port, proceeded to Philadelphia in ballast. She sailed from the latter port on Sunday for Stockholm with 1,300,000 gallons of refined petroleum in bulk.

Capt. A. W. Holmes has been appointed master of the steamer City of Genoa.

SEACOAST ARTILLERY STEAMERS.

The seacoast artillery steamers General Robert Anderson and General Richard Arnold are the first two of eight similar vessels being constructed by the Fore River Ship Building Co. for the quartermaster general's department of the Unted States army. The vessels are each 98 ft. long by 22 ft. in breadth and 12 ft. deep. They are constructed of mild steel throughout of the highest class in American bureau. The vessels have a straight stem and semi-elliptical stern with one continuous deck all fore and aft on which a commodious steel deck house is built with accommodations for the officers. On top of this deck house there is constructed a wood pilot house with officers' state rooms adjoining. The steamers are subdivided into six separate watertight compartments by transverse steel bulkheads extending to the main deck. These compartments comprise fore peak trimming tank, forecastle with accommodations for the crew, a large freight hold for the stowage of submarine mines, etc., boiler room, engine room, and after peak trimming tank and lazarette. Each tug has been rigged with one pole mast having a powerful derrick on the fore side of same for handling the mines.

These tugs have been equipped and constructed to conform with the requirements of the supervising inspectors of the United States and have all outfit, life saving appliances, etc., required by their rules, including two steel metallic lifeboats operated by swan neck Mallory type davits.

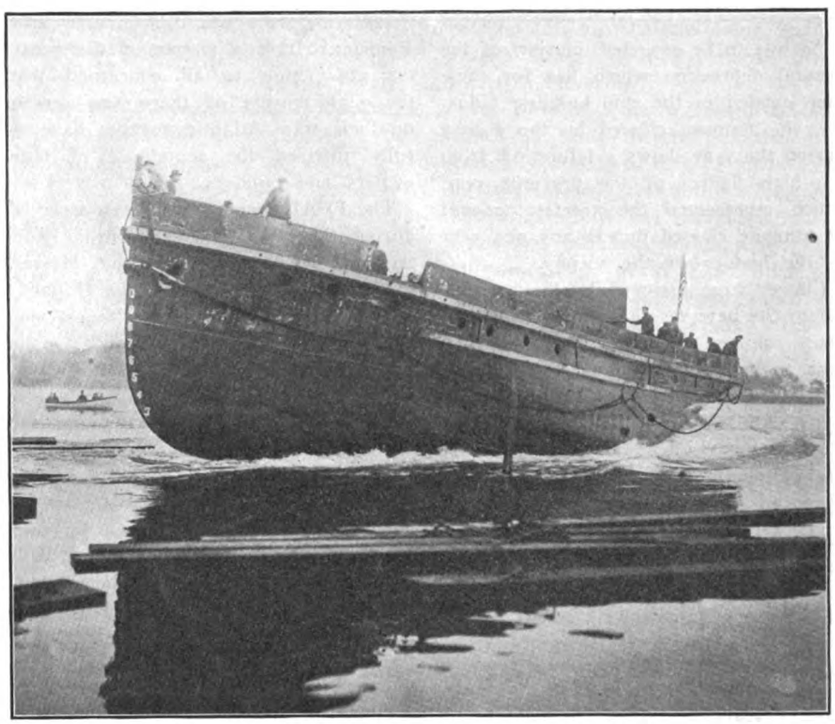
The machinery consists of one set of compound inverted direct-acting surface condensing engines having cylinders of 13 in. and 26 in. diameter, with a common stroke of 18 in. Steam will be supplied at a pressure of 150 lbs. per square inch from a single-ended Scotch boiler 11 ft. in diameter by 11 ft. 6 in. long, having two Morrison corrugated furnaces. It is esti mated that this installation will develop sufficient power to propel the vessels at a speed of 11 miles per hour on service. When delivered to the government these vessels will be utilized for the towing of targets to the practice grounds, for the laying of submarine mines and the transport of stores to artillery garrisons. They are exceptionally stoutly built craft, built to the highest grade and completely equipped in all departments, and should prove particularly efficient vessels for the service intended. The succeeding vessels of the type will be shortly launched and all of them delivered to the government before the end of the year.

Robert Anderson, after whom the Anderson is named, was born in Kentucky. He was appointed second lieutenant, Third artillery, on July 1, 1825, and first lieutenant, June 30, 1833. He was appointed captain, Third artillery, Oct. 23, 1841. He became major, First artillery, Oct. 5, 1857, and reached the rank of brigadier general May 15, 1861. He retired Oct. 27, 1863, breveted major general for gallant and meritorious service. His principal active service was in warfare against the Florida Indians and the battle of Molino del Rey, Mexico. He died Oct. 26, 1871.

Richard Arnold, after whom the Arnold is named, was born in Rhode Island, and was appointed to the military academy from that state. He was appointed second lieutenant, Third artillery, May 26, 1851, first lieutenant March 17, 1854, and became captain of Fifth artillery May 14, 1861. He became brigadier general of volunteers, Nov. 29, 1862. He was appointed major, Fifth artillery, May 1, 1875. He saw service in the battle of Savage Station, Va., Port Hudson, La., and Fort Morgan, Ala. He died Nov. 8, 1882.

NEW COLOR FOR WARSHIPS.

The navy department has recently given an order for painting all the ships of the navy slate color. This is the result of the trials which have lately been made of slate as a peace color and includes such ships as fleet colliers to be acquired, supply ships, repair ships and auxiliary cruisers, but excepts receiving ships, colliers now in the service, converted yachts, gunboats and small cruisers called upon to act singly. The Atlantic fleet is to be painted at once and the battleship fleet will receive its new coat at once upon its return from the trip around the world. The Pacific fleet is not to be painted until it gets back to the Pacific coast yards.



SEA COAST ARTILLERY STEAMER GENERAL RICHARD ARNOLD.

The particular slate shade selected is really a gray formed of white lead and lampblack. The new color is to be used primarily to assist the manipulation of vessels in fleet maneuvers, the white color making it almost impossible to avoid detection with searchlights at night. There is the further advantage in the fact that the slate color will save a good deal of money. After coaling hereafter it will only be necessary to turn on the hose and wash down the sides of the ship, and she will be as clean as ever, while with white it is frequently required to slap on the paint to get anywhere near the original virgin whiteness.

THE WORLD'S SHIP BUILDING.

At the close of the year ended June 30, 1908, 10,472 merchant vessels, registering over 20 million tons gross, held classes assigned by the committee of Lloyds Register. Further details are given in the following table:

VESSELS CLASSED IN LLOYDS REGISTER BOOK AT JUNE 30, 1908.

Material of construction.	Description.	British. No.	British. Tonnage.	Foreign. No.	Foreign. Tonnage.	Total. No.	Total. Tonnage.
Iron and steel	Steam	6,166	12,118,133	2,792	6,107,670	8,958	18,225,803
Iron and steel	Sail	573	914,456	724	1,005,104	1,297	1,919,560
Wood and composite	Steam and sail	202	30,375	15	5,438	217	35,813
Total		6,941	13,062,964	3,531	7,118,212	10,472	20,181,176

As was to be expected, in view of the general depression which has for some time existed in the ship building industry, the tonnage classed by the society during the year shows a falling off from the high figures of the previous year, which represented the greatest amount of tonnage classed during any one year in the history of the society.

Classes were assigned by the committee to 648 new vessels. Their registered gross tonnage amounted to 1,151,791 tons. Of these vessels, 605 of 1,147,547 tons were steamers, and 43 of 4,244 tons were sailing ships. These vessels were all constructed, in accordance with approved plans, under the special supervision of the surveyors to Lloyds Register. Of the total, 671,843 tons, or 58½ per cent, were built for the United Kingdom, and 479,948 tons, or 41½ per cent for the British colonies and foreign countries.

The following table sets forth the new tonnage classed by the society during the last 10 years:

	Steam.	Sail.	Total.
1898-9	1,302,329	20,357	1,322,686
1899-1900	1,236,831	18,908	1,255,739
1900-1	1,328,395	26,916	1,355,311
1901-2	1,381,750	43,666	1,425,416
1902-3	1,182,265	68,155	1,250,420
1903-4	1,051,960	27,085	1,079,045
1904-5	1,189,769	11,058	1,200,827
1905-6	1,408,579	4,066	1,412,645
1906-7	1,470,312	14,410	1,484,722
1907-8	1,147,547	4,244	1,151,791

Attention has been drawn in previous reports to the increasing tendency of ship owners to order vessels of special types designed to meet the requirements of particular trades. Of the total number of vessels classed by the society during the year under review, a considerable proportion are vessels of this description, the society's rules providing for the highest class being assigned to vessels of all types, so long as the standard of strength is satisfactorily maintained.

The most noteworthy vessel classed during the last 12 months was the Cunard Steamship Co.'s quadruple turbine steamer Mauretania, 31,938 tons, built by Messrs. Swan, Hunter & Wigham-Richardson, Ltd., at Wallsend-on-Tyne. Like the sister ship Lusitania, built by Messrs. John Brown & Co., Ltd., Clydebank, this vessel was constructed under the special supervision of this society's surveyors and holds the 100A1 class in Lloyds Register. It is a matter of the greatest satisfaction to all concerned that the achievements of these fine vessels on their trans-Atlantic voyages have so fully justified the confidence of both owners and builders.

The 100A1 class has also been assigned during the year to the steamship Rotterdam, 24,149 tons, built by Messrs. Harland & Wolff, Ltd., for the Holland-Amerika Line, which is the largest vessel registered in Holland, and to the steamship Tenyo Maru, 13,454 tons, built by the Mitsu Bishi Dock Yard & Engine Works, at Nagasaki, under the supervision of the society's exclusive officers at that port, for the Toyo Kisen Kaisha. This vessel, which is fitted to burn liquid fuel, is the largest yet constructed in Japan, and is the first built in that country in which turbine machinery has been installed. Two sister turbine vessels are under construction in the same yard and are also intended for the society's classification.

Other interesting vessels which have recently received or are intended for the 100A1 class are the twin screw steamer Salsette, for the Aden-Bombay service of the Peninsular & Oriental Steam Navigation Co.; the two triple screw steamers, Baron Gautsch and Prinz Hohenlohe, belonging to the Lloyd Austriaco; the Danish training ship, Viking, which is to be used for the training of officers for the merchant service; the steamer Paul Paix, and three other vessels on the longitudinal system recently patented by J. W. Isherwood; transport General Guerrero, built at Barrow for the Mexican government for the conveyance of troops, etc., and fitted with six 10 centimeter guns; four large vessels with heavy scantlings for the seal fisheries; one for the Canadian government, specially strengthened for service among ice on the Canadian lakes; and the steamer Transporter, built at Barrow, for the conveyance to Japan of two submarine vessels. Among dredgers classed by the society may be mentioned the Lord Desborough, built at Port Glasgow, for the Thames conservancy.

Since the issue of the last annual report, 49 steamers of upwards of 5,000 tons each have received the society's classification, of which the following exceed 10,000 tons each, viz.:

Name of vessel.	Tons.	Owners.
Mauretania	31,938	Cunard Steamship Co., Ltd.
Rotterdam	24,149	Holland-Amerika line.
Tenyo Maru	13,454	Toyo Kisen Kaisha.
Orcoma	11,533	Pacific Steam Navigation Co.
Pericles	10,925	G. Thompson & Co. Ltd.
Heliopolis	10,897	Egyptian Mail Steamship Co., Ltd.
Cairo	10,864	

A type of steamer for which there is an increasing demand is that designed for the carriage of oil in bulk. Fourteen of these vessels have been classed since June, 1907, and have all received the 100A1 character. At the present time there are no less than 27 oil carrying vessels with a total tonnage of 128,473 tons under construction with a view to classification in Lloyds Register book.

During the year numerous vessels of special types have received the society's A1 class, which is provided for vessels intended for particular purposes, or limited voyages, for which a high rate of speed, or shallow draught, is essential. Among these may be mentioned the steamers Slieve Bloom, Slieve Gallion and Rathmore, built for the London & North Western Railway Co.'s Irish Channel Service; and the turbine steamer Ben My Chree, belonging to the Isle of Man Steam Packet Co.

The numerous yachts classed by the society during the year include the steam yachts, Iolanda, 1,647 tons, and Liberty, 1,607 tons, built at Leith; the Cassandra, 1,227 tons, built at Greenock, and the turbine yacht Vanadis, 1,092 tons, built at Glasgow.

In the course of the year the plans of 554 vessels intended to be built of steel, 42 of wood, and 3 composite —making a total of 599 vessels—were submitted for the committee's consideration, with a view to the approval of the vessels for classification by the society.

The tonnage in course of construction under the inspection of the society's surveyors at home and abroad, on June 30 last, was 745,538 tons. This total, which is 300,000 tons less than that recorded 12 months previously, indicates the serious shrinkage which has occurred in the ship building trade in the course of the year.

During the year 611,000 tons of ship and boiler steel were tested by

the society's surveyors at home and abroad.

At the present time there are 72 steel manufacturing firms in the United Kingdom, and 145 abroad, recognized by the committee for the production of steel for use in the construction of vessels and machinery intended for classification in Lloyds Register book. Prior to such recognition being extended to any establishment it is necessary that the works shall have been inspected and reported upon satisfactorily by the society's surveyors. A full list of these steel works is contained in the society's book of rules.

The society's surveying staff now consists of 307 officers.

machines is included in table 22 of the rules.

The adoption of turbine machinery for the propulsion of merchant vessels, and the society's close association with the progress and extension of this type of marine engine, have been referred to in previous annual reports. Many turbine steamers, intended for a variety of purposes, have been classed with Lloyds Register, and their total tonnage now amounts to 165,922 tons, which is nearly twice as much as the similar figures for last year. The following list comprises the names of turbine steamers now sailing, which hold the society's classification, arranged in order of date of build:

Name of vessel.	Gross tons.	Year of build.	Owners.
Emerald (Yt.)	694	1903	Sir Christopher Furness, M. P.
Lorena (Yt.), now Atalanta	1,303	1903	G. Jay Gould, Esq.
Lhasa	2,171	1904	British India S. N. Co., Ltd.
Linga	2,171	1904	
Lunka	2,171	1905	
Lama	2,175	1905	
Albion (Yt.)	1,116	1905	Sir George Newnes, Bt., M. P.
Narcissus (Yt.)	661	1905	A. E. M. Mundy, Esq.
Dieppe	1,216	1905	London, Brighton & South Coast Railway Co.
Viking	1,951	1905	Isle of Man Steam Packet Co., Ltd.
Bingera	2,092	1905	Australasian United Steam Nav. Co., Ltd.
Carmania	19,524	1905	Cunard Steamship Co., Ltd.
Kingfisher	982	1906	General Steam Nav. Co., Ltd.
Rewa	7,267	1906	British India S. N. Co., Ltd.
Viper	1,713	1906	G. & J. Burns, Ltd.
St. David	2,529	1906	Fishguard & Rosslare Railways & Harbor Co.
St. George	2,456	1906	
St. Patrick	2,531	1906	
Immingham	2,009	1906	Great Central Railway Co.
Marylebone	1,972	1906	
Lusitania	30,822	1907	Cunard Steamship Co., Ltd.
Mauretania	31,938	1907	
Heliopolis	10,987	1907	Egyptian Mail S. S. Co., Ltd.
Hirafu Maru	1,484	1907	Japanese State Railways.
Tamura Maru	1,488	1907	
Cairo	10,864	1908	Egyptian Mail S. S. Co., Ltd.
Tenyo Maru	13,454	1908	Toyo Kisen Kabushiki Kaisha.
St. Andrew	2,528	1908	Fishguard & Rosslare Railways & Harbor Co.
Ben My Chree	2,651	1908	Isle of Man Steam Packet Co., Ltd.
Vanadis (Yt.)	1,092	1908	C. K. G. Billings, Esq.

The total length of chain cable tested during the year at the public proving houses in the United Kingdom, all of which are under the superintendence of the society, was 332,278 fathoms. The number of anchors tested was 7,961.

In addition to the above establishments there are 19 anchor and chain cable testing machines distributed over the continent of Europe, and 17 in the United States of America, which have been recognized by the committee, after the machines have been inspected by the society's surveyors, for the testing of anchor and chain cables to be supplied to foreign owned vessels which are classed, or intended to be classed, in Lloyds Register book. In these cases the the necessary tests are required to be carried out in the presence of the surveyors to the society. A list of these

The introduction of low pressure steam turbines in conjunction with reciprocating engines is at present occupying considerable attention and may lead to results which will add to the success already experienced with turbine machinery, by effecting greater economy in the use of steam and reduced consumption of fuel.

It is interesting to observe that the number of yachts, etc., which are fitted with oil, or petrol engines, is rapidly increasing. The number of such vessels in the current edition of the society's British yacht register amounts to about 650 and in the Register of American Yachts there are nearly 1,400.

Among the larger yachts recently constructed to the society's classification which have been fitted with such engines, are the Modwena, 400 tons; the Pampa, 225 tons, and the Muriel, 113 tons, while the Elizabeth, 236 tons, which was built in 1906, was similarly fitted last year.

The fact that the number of vessels holding this society's refrigerating machinery certificate is annually increasing is a gratifying assurance to the committee of the value which those connected with this important industry place upon the society's supervision.

There is also a further development to be recorded in the trade itself, the vessels engaged in it having now a total cargo capacity of over 12,000,000 carcasses of mutton. This shows an excess of over 2,000,000 carcasses as compared with the corresponding figures of two years ago.

There are at the present time nine refrigerating installations being fitted in vessels under the special survey of the society's surveyors.

As showing the increased attention which is being directed to this trade generally, reference may be made to the international congress of the refrigerating industries which has just been held in Paris and included representatives from all parts of the world. The British committee comprised the leading men connected with the refrigerating trade in this country and the colonies, this society being represented thereon by William Lund, chairman of the sub-committees of classification, and J. T. Milton, chief engineer surveyor.

The constitution of the technical committee of this society has this year been enlarged by extending to forgemasters the representation already enjoyed by ship builders, engineers and steel makers, the election of a representative forgemaster being vested in the English and Scottish Forgemasters' Association.

The technical committee have had under consideration during the year alterations, etc., proposed to be effected in the society's rules for the construction of ships and machinery. The principal subjects dealt with by the committee were the following:

Sizes of wood fore and afters fitted in hatchways.

Riveting of side plating of bridges and the thickness of bulkheads at fore end of bridges and poops.

Table S 7 as regards the scantling of double bottoms.

Table S 8 respecting the rivet attachment of floor plates to center girder.

Requirements regarding the quality and testing of steel castings and forgings for ships and machinery and the testing of stay bars for boilers, so as to bring these requirements into conformity with the standard specifications issued by the engineering standards committee.

Testing of oil tanks in vessels intended for carrying petroleum in bulk.

Stringer angles on poops, forecastles and short bridges.

Amended rules for beams and beam knees.

Amended rules regarding the fitting of close spaced transverse deep web plates with a view to dispensing with fore and afters in cargo hatchways.

British standard sections for ship building purposes.

Proposals for bringing the society's rules for ordinary yachts more into accordance with the rules of yachts for the international rating classes.

The recommendations made by the technical committee affecting the above matters were adopted by the general committee and have been incorporated in the society's rules.

The number of vessels to which freeboards were assigned by the society under the merchant shipping act, 1894, up to June 30, 1908, was 14,467. The number to which freeboards were assigned during 1907-8 was 397, representing an approximate gross tonnage of 967,700 tons. These figures refer to original assignments and are quite independent of a large number of reassignments under the amended tables. Of these latter cases 4,586 were dealt with up to the end of June, and it may be noted that according to figures which were recently given in the house of commons by the president of the board of trade, the committee of Lloyds Register have, during the past two years, assigned freeboards in five-sixths of the total number of cases dealt with by all the assigning bodies.

Reference was made in the report for last year to the negotiations which were then in progress between the British and German governments with a view to the assimilation of the freeboard regulations of Great Britain and Germany, so as to admit of the mutual recognition of the loadline certificates issued by both countries.

A conference was subsequently held in Hamburg, composed of eight representatives nominated by the German government, and eight by the British government, among whom were H. J. Cornish, the society's chief ship surveyor, and one of the principal surveyors on his staff. As a result of this meeting the German delegates agreed to amend their rules in order to arrive at as close an approximation as possible to the British rules, and the conference was thereupon able to submit to the respective governments proposals which would bring about the desired agreement between the two sets of freeboard regulations.

After considering the report presented by the British delegates, the board of trade intimated to the German government, through the foreign office, that they were prepared to accept the arrangement arrived at by the conference, and the German government have since issued the text of their amended freeboard regulations, which will come into force on and after Jan. 1, 1909. It is a matter for much congratulation to the two great nations concerned that this most important question has now been definitely settled.

As noted below, the French government have just adopted freeboard tables which appear to be substantially in agreement with the British regulations as regards the great majority of vessels, and it is hoped that the governments of the other principal maritime powers will shortly see their way to take similar action.

The new French shipping law which was promulgated in April, 1907, will, it is understood, come into operation in March, 1909, the necessary detailed regulations having been issued by the minister of marine towards the end of last month. Under the provisions of this law, all vessels which hold the highest classification of the Bureau Veritas or of Lloyds Register will be accepted without further survey as eligible to be granted the requisite "permis de navigation" as regards structure and condition of hull and machinery and equipment of anchors and cables. Similarly, so long as they retain their classification, vessels sailing under the French flag will be exempted from certain official periodical and other surveys in dry dock which are prescribed by the law. The societies above named are, moreover, empowered to assign and certify the freeboards which will now be compulsory in the case of French vessels. It is needless to say that the granting to Lloyds Register by the French government of these privileges is a matter of much graitfication to the committee, in view of the number of French vessels which hold the society's classification and also of the further evidence which it affords of the international recognition enjoyed by Lloyds Register.

Mention should also be made of the fact that surveys carried out by the surveyors to Lloyds Register are now officially recognized by the Russian government in connection with the conditions prescribed by the board of trade under the British merchant shipping act (1906), as regards the granting of passenger certificates to Russian vessels trading to or from ports in the United Kingdom.

It was intimated in last year's report that, at the request of the international conference on yacht measurement, uniform scantling requirements for yachts intended for racing in the international rating classes had been prepared by this society in conjunction with the Bureau Veritas and the Germanischer Lloyd.

These regulations received the approval of the international racing union and have been adopted for a period of 10 years from Jan. 1, 1908. Yachts built in accordance with the regulations under the inspection of the society's surveyors are classed "R" in Lloyds Register of yachts, and up to the present time 63 yachts have received this special "R" class, of which number 28 have been built abroad.

These racing yachts include the Osborne and the Nino, for H. M. the King of Spain and H. R. H. the Duc d'Orleans, respectively; and the 23-meter yacht Shamrock, for Sir Thomas Lipton, Bart.

The yachts Cobweb and Dormy, winners of the international races for the 8 and 6-meter classes respectively in connection with the Olympic games regatta, both hold the society's classification.

In 1906, the committee granted three Lloyds Register scholarships in naval architecture at the Armstrong College, Newcastle-on-Tyne, as a mark of their appreciation of the endeavor which was then being made to found a school of naval architecture for the north east coast.

More recently a special effort has been made to advance the study of marine engineering, and the committee has had much pleasure in deciding to establish two "Lloyds Register Scholarships," each of the annual value of £50, in connection with the institute of marine engineers, with a view to enabling young engineers to pursue a course of study in engineering at a university or approved college. One of these scholarships will be open for competition each year, the arrangements being left in the hands of the council of the institute of marine engineers.

In addition to the three scholarships at the Armstrong College referred to above, the committee, many years ago, established three scholarships in naval architecture at Glasgow university, so that, including the two recent foundations, there are now in existence eight Lloyds Register scholarships of the yearly value of £50 each.

GREAT LAKES SUPPLY CO.

The Great Lakes Supply Co., 11-13 Main street, Buffalo, has fully recovered from the recent fire at its Buffalo store and is stocked as before with a complete line of marine supplies, everything for the fitting out of vessels, including groceries, meats, ice, cordage, paints and oils. The company has also a complete line of the same character at the Duluth headquarters, which is at 245-247 Lake avenue, south. Both stores are equipped with engineers' supplies and provide launch delivery service.

The steamer Fred Mercur, loaded with coal from Oswego, went ashore near Cape Vincent last week in a fog.

LARGEST DREDGER AFLOAT.

Cammell, Laird & Co., Birkenhead, recently launched for the Mersey docks and harbor board a sand pump dredger, the largest and most powerful vessel of its kind afloat. The dredger is named Leviathan and its principal dimensions are: Length, 476 ft.; breadth, 69 ft.; depth, molded, 30 ft. 7 in. She will have a total deadweight carrying capacity of about 11,000 tons, 10,000 tons of which will be sand, the remainder being made up of bunker coal, fresh water, stores, etc. Her draught will be 23 ft. The chief dimensions of the Coronation, which was built by Vickers, Sons & Maxim, Ltd., in 1903, and which is the largest vessel of the type hitherto used by the Mersey dock board, are: Length, 332 ft.; breadth, 52.7 ft.; mean draught, loaded, 17 ft. 2 in.; and load, 3,500 tons.

The hopper capacity of the Leviathan is 180,000 cu. ft., and this space is to be filled from a maximum depth of 70 ft. within 50 minutes, and as the total load displacement is 18,000 tons exceptional strength of the hull and jointing is necessary. There are 21 water-tight compartments. The shell plates are ¾-in. thick, 28 ft. long, and each weighs 2¾ tons; the butts are quadruple riveted. The dredging will be done by four centrifugal pumps, and each will be driven by an independent triple-expansion engine. The pump room is situated immediately forward of the boiler room, which again is forward of the hoppers. There are 12 hoppers, and the sand from the pumps is passed into them through valves in the two landers. The valves are operated by hand gear, and can be opened or closed at will to regulate the trim of the vessel when pumping. The discharging of the spoil from the hoppers is carried out by means of the Lyster hydraulic discharge valve. These valves are large hollow cylinders fitted in the center of each hopper covering circular openings 5 ft. 6 in. diameter in the bottom of the hoppers. When discharging the valves are raised 4 ft. by hydraulic power worked from the fore and aft bridges by hand levers.

The propelling machinery consists of two sets of inverted vertical triple-expansion engines with cylinders 22½ in., 37 in. and 61 in. diameter by 45 in. stroke. These engines have been built by D. Rowan & Co., Glasgow, and are of 3,500 H. P. They are to be capable of propelling the vessel at a speed of 10 knots. Steam will be supplied by four large single-ended boilers 16 ft. diameter by 11 ft. 9 in. long. The dredging apparatus consists of four suction pipes, 42 in. diameter, connected to the pumps through the ship's sides. The pumps have sluice valves, which can be closed by hydraulic power, and the tubes can be hoisted upon deck by eight powerful winches and jibs. When they are hoisted on deck slides carry them inboard, the slides being operated by worm gearing. In addition to the pipe hoisting winches there are four large steam winches for warping purposes, also for use in cases of emergency, such as breakdown of the pipe hoisting winches. The vessel is also equipped with a powerful double steam windlass, and hand and steam steering gear, and she will be lighted throughout by electricity.

In the existing types of sand pump dredgers employed by the Mersey dock board the surface water overflows from the hopper over the decks and then over the vessel's sides. In the Leviathan this system of deck swamping will be obviated, as the overflow will find its way over two weir plates to outlets through rectangular trunks immediately above the load line. The hydraulic engines have been built by Cammel, Laird & Co., Ltd., and the suction nozzles and jibs by D. Mechan & Sons, Glasgow. Accommodation for the officers and engineers has been provided in the poop and for the crew in the forecastle, while a house for the masters is situated on the navigating bridge.

WIRELESS TELEPHONY.

A series of important tests with Dr. de Forest's system of wireless telephony have just been concluded at Portsmouth. The inventor and a party of naval officers have been out daily, either in the cruiser Furious or the destroyer Velox, and messages have been spoken from those vessels to the Vernon torpedo depot in Portsmouth harbor, a distance of 40 miles, the Hertzian waves having to cross the Isle of Wight to reach the Vernon. The tests were considered very satisfactory.

The British steamship Aeon, which has been missing for several weeks, has been heard from. She is fast on a coral atoll known as Christmas island, in the Pacific, wrecked beyond hope of salvage. The ship's company, 50 in all, were all landed safely at a small settlement on the island, after which the second officer fitted up a ship's boat with a gasoline engine which was taken from the cargo, and with two of the engineers voyaged to Fanning island, 140 miles distant, to cable news of the disaster. The Canadian-Australian liner Manuka called at the island and took off the survivors, landing them at Sydney.

PACIFIC COAST CO.'S PROFITS.

The financial statement of the Pacific Coast Steamship Co. is of special interest this year in view of all that has been said regarding the unprofitable nature of the Oriental trade. President H. W. Cannon in his annual report submitted to stockholders last week in Jersey City, takes occasion to remark: "The largest decrease in gross and net earnings is shown by the Pacific Coast Steamship Co. The Columbia & Puget Sound Railroad Co., the Pacific Coast Railway Co., and the lumber yards in California also show decreases in gross and net earnings.

"The business depression, following the panic of the autumn of 1907, was severely felt by our company, and the reduction in receipts and profits for the last six months of the fiscal year, viz., from Jan. 1 to June 30, 1908, were very large. Labor conditions on the Pacific coast, from an employer's standpoint, continue unsatisfactory. Freight rates could not be increased, or the price of coal advanced, to meet the higher cost of service, material and supplies."

Briefly gross earnings fell off $133,537, while operating expenses increased $234,000, so that net earnings decreased $367,547. The balance available for dividends amounted to $621,609, equal to 4 per cent on the $1,525,000 first preferred, 6 per cent on the $4,000,000 second preferred and 5.4 per cent on the $7,000,000 common stock.

The general balance sheet as of June 30 compares as follows:

ASSETS.

	1908.	1907.
Property	$19,083,959	$18,736,725
Bonds and stocks in treasury	96,978	.....
Cash	335,157	880,469
Accounts receivable	1,013,870	366,512
Agents' accounts	66,826	804,128
Surplus on hand	1,412,437	772,087
Other assets	707,964	4,573
Total	$22,717,194	$21,559,921

LIABILITIES.

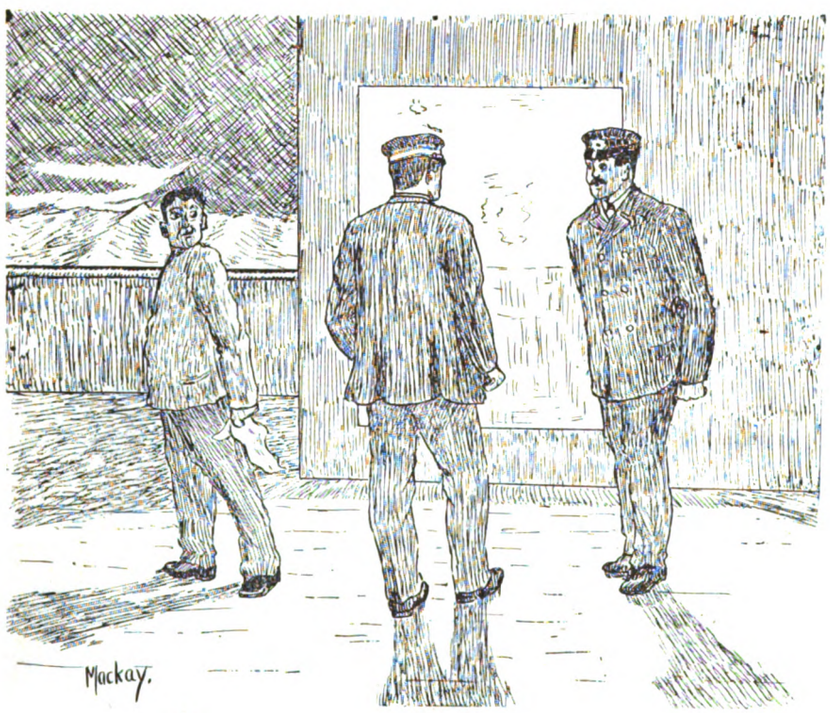
Capital stock	$12,525,000	$12,525,000
First mortgage bonds	5,000,000	5,000,000
Unpaid vouchers	904,778	182,451
Unpaid pay rolls	152,353	149,060
Interest on bonds	20,833	20,833
Taxes accrued	5,208	13,020
Contingent liabilities	462,534	134,965
Miscellaneous	146,955	16,913
Surplus property contingent	437,500	499,755
P. & L. surplus	3,062,032	3,017,922
Total	$22,717,194	$21,559,921

At the annual meeting the retiring directors were re-elected.

A report of the survey of the torpedo boats Nicholson and O'Brien has been received at the navy department. The report recommends that the vessels be overhauled and new boilers installed. It is probable that the work will be done at the Norfolk navy yard.

"In the Merchant Service"

Johnson, third engineer of the Alroma, had retired to the sacredness of his cabin and—like Robert Bruce—had "thrown himself down in a lonely mood to think." Perhaps it was the strenuousness of the afternoon watch or the high temperature of the boiler rooms due to the proximity of the Gulf stream, but the fact remained that he wasn't feeling just right. When a man is blessed with an unusually good constitution, or has been fortunate enough to escape most of the little ills that overtake us in this life, he isn't expecting the cruel blow when it does arrive, and is not at all prepared to receive it.



HE CASUALLY MENTIONED THE THIRD ENGINEER'S SEEMING INDISPOSITION.

A pain in the region of the temples may, through ignorance, be sneered at. According to Mother Migging's Medical Manual it is one of the symptoms of exactly 433 ills, and was, therefore, a serious matter. Johnson had discovered this in his hurried perusal of a borrowed copy of the Manual, with harrowing effect. Here was a pretty pickle for a fellow to be in! The Fourth's suggestion that Johnson get on the outside of a good stiff peg of rum did not seem to be at all in keeping with the gravity of the situation. The other suggestions offered from various sources were also ignored with patient resignation. So the Third listlessly disrobed and crawled underneath the blankets.

Sleep, however, refused to come to the heartsick invalid. With the light switched off and the room in utter darkness, the pages of Mother Migging's Medical Manual were still—metaphorically—being hurriedly scanned. Even the pages dealing with fits and drowning accidents were of interest. True, in some cases it was considered advisable to enlist the services of a doctor, but the Third had his own opinion of the medical profession. Wasn't the ship's surgeon a friend of his? Didn't he know that the doctor was a mighty fine fellow? But, in a case of life or death —.

A familiar step sounded in the alleyway and a heavy hand knocked at the door. The Third, too disgusted even to answer, laid low. The knock was repeated, with the same result; then the door was cautiously opened and the Fourth looked in.

"Turn out, you sleepers!" bawled the Fourth, jerking the curtain from in front of the invalid's bunk. When he saw his victim's face the surprise he felt was shown on his own.

"Aren't you going to turn out for supper?" he asked, gently throwing the Third's hastily-discarded clothing from the chair and seating himself therein.

"I don't want any supper," answered the Third, in a weak voice. He was readjusting the curtain.

"Not going to eat?" asked the Fourth, in wonder, "what's the matter with you?"

"I told you already I wasn't feeling good," said the Third, querulously.

"Oh, yes," nodded the visitor, "a headache or something, isn't it? Did you try a peg o' rum?"

A hand, unseen by the Fourth, emerged from the head of the bed and hovered over the lamp switch. There was a sharp click, and the room was again in utter darkness.

"You might leave a fellow alone for a little," said the weary voice of the Third.

"What did you say, Joe?" asked the Fourth, scarcely believing his ears.

"I said, 'leave a fellow alone for a little,' if you particularly want to know," repeated his superior. And the intruder stole softly away.

"It's a funny thing," ruminated the Third, as he arranged his pillows, "that a fellow who makes a habit of pounding his ear about 12 hours out of 24 can do so without causing unseemly comment, and another who, like myself, gets along with as little sleep as possible, can't take a couple more than usual without the fact being—well—entered on the log sheet. Darned if I ever saw such a ship for—."

Another knock at the door.

"Come in," growled the Third, pushing his head out between the curtains.

This time it was the steward.

"Supper, Mr. Johnson," said that individual, with an ingratiating smile.

"All right, thanks," said the Third, settling back in bed, "I guess I don't want any tonight, steward."

"Huh?" gasped the astonished steward. The idea of Mr. Johnson not wanting any supper!

"I said I didn't want any supper," repeated the Third; impressively.

"'Will I bring you a little—" began the willing steward..

"No," yelled the Third, assuming a sitting position in bed, "get out!"

"Huh?" said the steward again, wondering what had come over the usually affable Third.

"Beat it!" yelled the Third. And the steward hastily withdrew.

"What's coming over this ship?" asked the Third of himself, when once more alone, "seems to me that everyone is going daffy. When I am all right again—that is, if I do get all right—I will let some of those funny fellows see who is third engineer of

this hooker. This is what comes of being too darned sociable, curse it!"

The steward stopped the Fourth on his way to the mess-room, giving it as his opinion that something serious was the matter with the Third. The Fourth, beyond expecting another vacant chair at the supper table, had practically dismissed the matter from his mind. Now he decided to see what the doctor could do, and, meeting the doctor immediately on leaving the steward, he casually mentioned the third engineer's seeming indisposition. The doctor was surprised, but decided to pay a friendly and to all appearance unprofessional call immediately.

"Hullo, old man," was his greeting, as he took the seat recently vacated by the Fourth, "it's just about your supper time, I believe."

"Is it?" said the Third, eyeing the doctor narrowly, and giving up—for the meantime—all attempt to count his own pulse.

"Don't you think a little sea air would do this room good." asked the doctor, loosening the bolt and letting the port swing open, "that's a bad cigar you've been smoking."

"It so happens that it was a pipe," retorted the Third, adding, "how're all the patients? Dead?"

The doctor ignored the remark, smiling blandly the while. He was still running his eyes round the cabin, letting them occasionally rest on the face of the Third. This the invalid, whose faculty of observation was more than usually alert, noted with mingled feelings.

"Why don't you get up and have your supper." asked the doctor.

"Huh?" said the Third, preparing to frustrate any designs the doctor might have on him.

"What are you doing in bed at this hour?" pursued the doctor.

"Well," said the Third, swinging his legs over the leeboard of his bunk and dropping on the floor, "you see, I had a bit of a headache."

"You had," said the doctor, "have you a headache now?"

"No, my noble pill dispenser!" said the Third triumphantly, "and if I did have I'd steer clear of your clutches!"

The doctor smilingly eyed the Manual—open at the feverish page—and proposed the Third join him in a cigar after supper. Then he also took his departure.

Supper was nearly over in the engineers' mess room when the Third hurriedly entered. As he took his usual seat he ran a scowling eye along the surprised and smiling faces at the table. He also scowled at the steward. Then he spoke.

"Let's have some o' that clam chowder, an' Irish stew, an' plum pudding," he said, "an' be damned quick about it!" THE "STAND-BY" MAN.

NOTES AND CLIPPINGS.

The Suez canal is blamed for allowing big Indian sharks to enter the Mediterranean.

The herring season just concluded on the British coast ranks as one of the worst in many years. At Seahouses, Northumberland, the catches represented a falling off in money value of $125,000.

There are now fully 200 Port Glasgow men employed in the various departments of the ship building yard at Trieste, Austro-Hungary.

Eight vessels have landed 1,100 seal skins at Victoria, B. C. These skins are the sort of which swagger jackets are made, and are not to be confused with the Greenland seal skins, which are only useful for making leather.

After a steamer has been laboriously transported in sections across some of the highest mountains in the world, for use on inland waters, it is certainly annoying to find that the boiler is too small. This is the complaint made by a French syndicate in South America regarding a steamer supplied by a Clyde ship building concern.

Anthracite differs from the ordinary variety of coal in that it contains but little hydrogen. Welsh anthracite contains more than 94 per cent of pure carbon. It is much more difficult to light than other coal, burns slowly and without flame, and is used mostly where a smokeless fire is necessary.

A master-at-arms on the steamer Campania, of the Cunard Line, fell overboard recently while the vessel was at anchor in the Mersey. Mr. McDougall, the first officer, at once plunged over and succeeded in sustaining the man until a small boat launched from a ferry in the vicinity came to their aid.

One of the statements given in evidence in the inquiry into the burning of the yacht Ceylon recently was that she was towed into Southampton, Eng., by a Dutch tug. It was added that the Dutch tug was named John Bull.

When the shore boat was swamped alongside the British battleship Africa in Dunbeath Bay, last month, a sailor who was lying in the ship's hospital forgot himself to the extent of jumping through a porthole and rescuing a boy who was being taken under by the suction.

The Leviathan, the largest dredge in the world, was launched on the Mersey, England, on Oct. 26. Its capacity is 10,000 tons in 50 minutes.

A naval inventor has utilized the ordinary canvas cover of ship's boats so as to form a buoyant raft by the introduction of cork and bamboo cane. This additional element of buoyancy occupies no more room and adds little weight to the customary equipment of a ship's boat. The buoyant cover, when a boat is being launched, is thrown overboard or laid aside. The idea has evidently been well considered and its advantages recognized, as the makers have just completed an extensive order for the British admiralty dock yards.

Mrs. Bertha Ayrton has succeeded in ascertaining the cause of the refractory behavior of the searchlight in certain respects, and is devising a remedy. Prof. Ayrton, after making many investigations, turned the problem over to his wife, who is the only woman member of the British institute of electrical engineers, and who received the only medal ever awarded to a woman by the Royal Society of London for original unaided work.

A breech-loading life-saving gun invented by Frank G. Hall, of the New York naval militia, recently underwent exhaustive tests at Newburgh, N. Y. The gun can be fired from the upper deck of a vessel much the same as the modern rapid-fire gun, and is designed for accurate work. The vessels of the revenue cutter service are to be equipped with this gun, the new cutters Snohomish and Acushnet being the first to have the gun installed.

Very satisfactory results have attended the experiments with the DeForest system of wireless telephony, which are being carried out by the British admiralty at Portsmouth. Communication was kept up between the experimental ship Furious and the torpedo school ship Vernon, at the station, messages being distinctly heard over a distance of 50 miles. A few interruptions occurred owing to the use of wireless telegraphy by the ships in the neighborhood.

A Norwegian inventor is stated by "L'Electricien" to have made use of a microphone to amplify sounds transmitted under water. The instrument is enclosed in a watertight box of thin sheet steel, and dropped into the water. This is kept in constant connection by suitable wires with a telephone receiver fixed on board the fishing boats, and it is asserted that by this means the approach of a shoal of fish can be instantly detected. It is said that each kind of fish makes a sound of special description which after a little practice can be recognized.

REVENUE CUTTER SNOHOMISH.

Herewith is published the engine room data of the trial of the Snohomish, the revenue cutter intended for service on Puget Sound. This steamer was built by the Pusey & Jones Co., Wilmington, Del. The principal dimensions of the Snohomish are: Length over all, 152 ft.; length between perpendiculars, 139 ft. 6 in.; breadth of molded beam, 29 ft.; depth, 17 ft. 6 in. Her engines are triple-expansion, 18, 29 and 47 in. cylinder diameters by 30-in. stroke, operating under a steam pressure of 180 lbs. She has one Scotch and one water-tube boiler.

BIDS FOR BUILDING SUBMARINES.

Bids were opened at the navy department Nov. 2 for the construction of eight submarine torpedo boats as authorized by congress, for which purpose $3,500,000 was appropriated.

There were three bidders, viz.: The Electric Boat Co., of Bayonne, N. J.; the Lake Torpedo Boat Co., Bridgeport, Conn., and the American Laurenti Co., of Philadelphia, Pa.

The Electric Boat Co.'s bid for boats of 425 tons displacement is from $414,000 to $444,000, according to the classes and number of the boats built on the Atlantic coast. For constructing the same boats on the Pacific coast the prices range from $446,000 to $461,000. For a boat of 375 tons displacement the prices range from $360,000 to $390,000, and for the same boats constructed on the Pacific coast from $388,000 to $403,000.

The Lake Torpedo Boat Co. bid on boats of 518 tons displacement from $435,000 to $460,000, the same boats built on the Pacific coast being quoted from $482,900 to $500,000. On vessels of 410 tons displacement the prices ranged from $382,500 to $410,000, built on the Atlantic, and from $425,000 to $435,000, built on the Pacific coast.

The bid of the American Maurenti Co. of Philadelphia, Pa., was for one or two boats of 532 tons displacement at $437,500.

The Hamburg-American liner Kaiserin Augusta Victoria sailed from Hamburg recently for New York via Southampton and Cherbourg, with the largest number of steerage passengers coming to this country in one vessel since the beginning of the present year, she having carried 1,054 persons in the steerage and 641 in the first and second cabins.

ENGINE ROOM LOG, U. S. REVENUE CUTTER SNOHOMISH, ON TRIAL TRIP, DELAWARE RIVER AND BAY, TRIAL HELD ON SEPT. 15, 1908.

Left dock, 8:08. Trial began, 8:30. Trial ended, 12:30. Returned to dock at 5:23. Draught forward, 10.3. Draught aft, 14.3. Mean draught for trip, 12.3. Number of men on board, 58. Weather, cool, fresh breeze.

Engine, 18"x29"x47" by 30. Mean engine constants, H. P. 0.03855, M. P. 0.10005, L. P. 0.26285. Circulator, 8" L. H., 7"x7" engine. Air pump twin, 8"x16"x12". Main feed pump duplex, 8"x5"x12". Aux. feed pump duplex, 8"x3"x12". Bilge pump simplex, 8"x9"x12". Distiller circulator pump duplex, 6"x6"x10". Evap. feed pump simplex, 3½"x2½"x4". Air compressor pump simplex 4½"x5½"x6". Fire pump duplex, 14"x8½"x12". Dynamo. Propeller, 11 ft. diam., 11 ft. pitch, 46 sq. ft. bel. area.

Time.	No. of card.	Counter.	Difference.	R. P. M.	Boilers.	Aux. steam.	Pressures. H. P. receiver.	M. P. receiver.	L. P. receiver.	Vacuum.	Mean Effective Pressure. H. P.	M. P.	L. P.	I. H. P. H. P.	M. P.	L. P.	I. H. P. of engine.	R. P. M. Circulator.	Dynamo.	Air pump.	Double Strokes Per Minute. Main feed.	Bilge.	Sea.	Water Temperatures. Discharge.	Hotwell.	Feed.	Air Temperatures. Outside.	Engine room.	Fire room.	Funnel temp.	Electric Plant. Voltage.	Amperage.
8:30	1	346,962	.....	.....	170	63	152	55	6	26	94.3	32.12	13.74	458	407	454	1,319	205	400	28	17	10	70	106	132	170	70	103	120	500	110	18
9:00	2	350,796	3,834	127.8	162.5	63	150	55	6	26	91.3	32.12	13.46	453	412	451	1,316	195	400	32	18	10	69	118	121	208	70	109	97	510	110	18
9:30	3	354,565	3,769	125.6	172.5	65	165	60	10	25	102.6	36.44	15.74	500	456	518	1,474	202	400	32	17	28	69	121	126	210	70	110	102	500	110	18
10:00	4	358,444	3,879	129.3	150	65	156	58	6	26.5	93.75	33.09	13.09	468	428	448	1,344	200	395	30	17	30	69	121	120	192	70	110	108	460	110	18
10:30	5	362,236	3,792	126.4	162	65	155	58	8	26.5	95.52	33.57	14.06	468	428	470	1,366	198	400	30	14	21	69	121	119	173	70	108	110	480	110	16
11:00	6	366,090	3,854	128.5	161	64	155	55	7	26.5	93.13	34.05	14.06	462	438	476	1,376	211	400	32	15	18	69	120	120	176	70	106	121	475	110	16
11:30	7	369,860	3,770	125.7	154	65	138	48	4.75	26	84.7	30.2	12.6	412	380	418	1,210	201	405	38	11	16	70	113	116	170	70	107	94	460	110	16
12:00	8	373,370	3,510	117.0	127	65	121	44	1.50	26	77	27.32	11.24	347	319	345	1,011	200	400	32	12	18	69	106	107	220	70	106	94	445	110	16
12:30	9	376,906	3,536	117.8	127.5	65	121	45	1.50	26	77.6	28.05	11.14	352	330	345	1,027	200	400	28	11	18	69	108	114	223	70	107	98	420	110	18
			3,743	124.75	155	64.4	145.9	53.1	5.64	26	89.98	31.88	13.23	435.5	399.7	436	1,271.4	201.3	400	31.3	14.6	18.7	69.2	114.9	119.4	193.5	70	107.3	104.9	472.2	110	17.1

Coal consumed, 6 tons, 4 hours. Average, 1½ tons per hour.

AROUND THE GREAT LAKES.

Work on the new dry dock for the Buffalo Dry Dock Co. has been started by the Great Lakes Dredge & Dock Co.

The steamer Midland King grounded abreast of the Watson coal dock at Detour, and the tug General was sent to pull on her.

A maritime lien has been placed on the steamer Louisiana by the Carroll Bros. Foundry Co. of Houghton, Mich., who allege that the vessel owes them $358.15 for repairs. The Carroll Bros. operate a foundry at Houghton and did work upon the Louisiana when she sank in Portage Lake canal last year. They admit that $300 of their original bill has been paid.

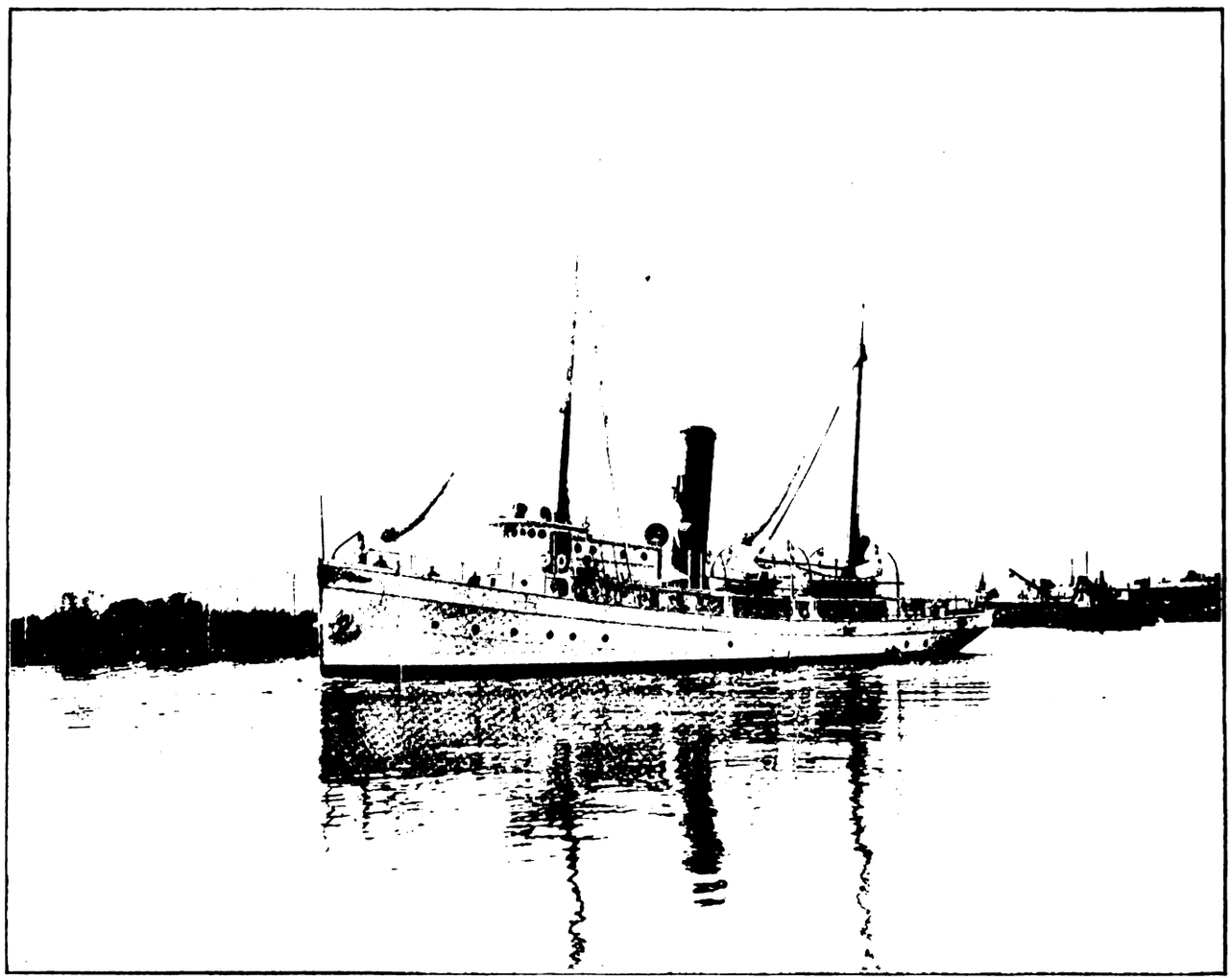
The steamer Elba of the Lackawanna Co.'s fleet ran aground in the channel at Bar Point owing to low water. She was released after lightering about 200 tons of her cargo of coal.

The fire tug Wm. A. McGonagle, building for the Duluth, Mesabi & Northern railway, was launched at the Lorain yard of the American Ship Building Co. at noon Thursday. She is named in honor of the vice president of the railroad and is intended to protect the company's property at the head of the lakes.

Charles Potter, a mate on the steamer Hoover and Mason, has been awarded a Carnegie medal for rescuing George Murtart, of Munising, Mich., on Oct. 22. Murtart was adrift in an open boat on Lake Superior for three days when the steamer Hoover and Mason came along.

The steamer Daniel B. Meacham, which went on the rocks near Eagle river, delivered her cargo of ore in Cleveland and then went to the Ecorse yard of the Great Lakes Engineering Works for repairs. It is not likely that she will make another trip this season.

The steamer Sacramento seems to be having bad luck this season. While entering the harbor of Superior on Oct. 14 she collided with the Mataafa, outward bound, and was sunk. A patch was put over the hole in her port side and she was pumped out and proceeded under her own steam to the Lehigh coal dock where her cargo of coal was discharged. She then endeavored to go into dry dock without the aid of a tug and ran into some obstruction between Tower Bay Slip and Howard's pocket. This opened the patch and she began to fill. Whistles of distress brought the tug Record and she was towed into shoal water. The Sacramento was subsequently taken to dry dock and surveyed and temporarily repaired. Capt. Davidson, owner of the steamer, desired to take her to his own ship yard at Bay City, but the marine inspector pronounced her unfit for the voyage and the custom house denied her clearance. The Sacramento was accordingly towed out into the harbor and anchored.



REVENUE CUTTER SNOHOMISH FOR SERVICE IN PUGET SOUND, BUILT BY THE PUSEY & JONES CO., WILMINGTON, DEL.

Gas Driven Ship.

BRITISH EXPERIMENTS ON BOARD H. M. S. RATTLER.

Worldwide attention has been drawn to some very important experiments that are at present being carried on by Messrs. W. Beardmore & Co., of the Naval Construction Works, Glasgow, which have for their object the development and perfecting of the gas engine as the new motive power in the propulsion of ships. The reports that have already been circulated about the revolution which this new agent in marine propulsion is about to create are not quite accurate, and are certainly very much exaggerated. We are able to give the following particulars which we have obtained first hand from Messrs. W. Beardmore & Co., through their chief engineer, William W. May, whom our British representative interviewed while the experiments were being carried on on board the gunboat Rattler.

This vessel being now obsolete for the British admiralty requirements has been acquired by the Marquis of Graham, who commands the Clyde division of the royal naval volunteers, as a sea-going training ship for the Clyde royal naval volunteers, and the marquis, who has faith in the future of this new type of engine, has permitted Messrs. Beardmore & Co. to install on board a gas producer plant and gas engine with the view of bringing the new power before the notice of owners of small commercial craft to which the patentees believe it to be especially applicable. The old machinery of the usual horizontal triple-expansion type has been replaced by a five cylinder single acting gas engine together with producer plant. A feature of this plant is the great economy of coal, it being calculated that the consumption of the anthracite coal used was equivalent to 0.8 lb. per horsepower per hour, while the machinery is about 25 per cent less in weight than the old engines. It should also be noted that the saving in space by the absence of boilers is very marked, for the stokehold as known on steamers of today is practically abolished, while there is also a great saving in labor. The whole staff engaged at the engines consists of three engineers and two firemen, and contrasted with the present conditions in the stokehold, the producer plant room and the engine room are airy and cool. This latter, in the opinion of the Marquis of Graham, is a great achievement in itself. He is of opinion that if one could abolish the stokehold on board ship it would be an act of mercy, and in his opinion this new system of generating steam on board ship will go a long way towards achieving that end.

The coal is put into the producer at the top, a charge of about 90 lbs. weight being put in every hour which is sufficient to maintain the 500 horsepower indicated for one hour. No trimming or dressing is required, the coal being all used up and nothing left but a residue of pure ash. After leaving the producer the gas passes through a cooling tower where it is treated by sprays of water, and thence to a centrifugal drier. This consists of a fan in a chamber revolving at a high rate of speed. The gas being lighter, remains in the center of the drier, and the high speed of the blades throws the water and grit to the sides, and passes to a water seal. The cleaner into which the gas is drawn consists of a cast iron box on the side of which is a series of baffle plates. The gas on its passage through impinges against the plates, and leaves behind any remaining water or grit, thence the gas passes to the mixing valve and to the main gas pipe for distribution among the five cylinders. On the gas being drawn into the cylinders it is compressed and fired by a magneto, the sparking plug being of the make-and-break type. The exhaust gas is treated by means of an exhaust drum. In this there is placed a nest of tubes, through which water is circulated. The steam generated from the cooled exhaust is used, and a supply of hydrogen secured for the gas. The exhaust drums, it may be added, also act as silencers, and the cylinders of 20-in. diameter and 24 in. stroke produce 500 I. H. P. at 90 revolutions per minute and drive the vessel at an average speed of 10 knots.

While the owners of the Beardmore engine claim that the application of the gas engine to marine engineering would revolutionize the mode of propelling vessels designed to travel at slow speeds, it could never compete with the steam turbine at high speeds, for the limit of its usefulness is reached at a speed at which that of the turbine only begins, namely about 14 knots. As an auxiliary power to sailing vessels it is claimed to supply the desideratum of economy in fuel and space. Messrs. Beardmore & Co. have invited on board the Rattler the leading marine engineers of Britain to inspect the new engine, and among these the impression created is said to be very favorable indeed.

WARSHIP DEFECTS.

Secretary of the Navy Metcalf has recently revoked the prohibition placed upon naval officers who were in attendance at the Newport conference the past summer by which they were prevented from discussing its action.

A naval officer who was present at and identified with the proceedings of the conference has stated that it had substantiated the charges concerning defects which had been pointed out in Commander Key's letters upon that subject and that the conference had decided that very few of these defects could be remedied in the North Dakota and Delaware, which are now 40 per cent completed.

The conference also hesitated to recommend extensive changes in the plans of the Florida and Utah, as the plans for these vessels require five or six months for their preparation and any considerable changes in weight would require a reconstruction of the plans. As now designed the two aft turrets on the Florida and Utah type are on the same level, and it was proposed, if practicable, to raise the second turret from aft so as to allow it to fire over the aft one.

The conference came to no decision as to what ought to be the type of the next battleships to be designed nor what kinds of batteries and armor should be used on them.

On account of low water in the river Oder the launching of the North German Lloyd liner George Washington, which was to have taken place Oct. 31, has been indefinitely postponed.

The Moran Co., Seattle, Wash., has been awarded contract for repairing the Alaska steamer Cottage City, which was recently badly damaged in a collision with the schooners Bainbridge and Blakely. The repairs are to be completed in 36 working days and will bring the company $26,230.

The Southern Marine Works, at New Orleans, La., has been purchased by V. Loisel, F. W. Sadler, W. J. Tierney, et al., and has been renamed the Union Marine Works. The plant has excellent facilities for the repairing of hulls, boilers, etc., and also manufactures marine boilers, engines and mill machinery.

THE INTERNAL-COMBUSTION ENGINE.

BY W. G. WINTERBURN, VICTORIA, B. C., IN THE *Steamship*.

The probability of motor launches being added to the equipment of modern steamshps in the near future necessitates the addition of yet another subject to the encyclopedic knowledge required of the present-day marine engineer: for those who have not given the sbject much thought as yet, I propose to give an elementary description of the gasoline engine as used for propelling small vessels.

GENERAL PRINCIPLE.—The action of the internal-combustion may be likened to the discharge of a gun; imagine the cartridge to have the shell extended forming a trunk piston; a connecting rod is suspended from the nose of the bullet, its other end attached to a crank outside the barrel; on the crankshaft is fitted a heavy flywheel.

When the detonator is struck it explodes the charge, the reaction of which drives out the bullet, but being trammelled by attachment to the crank transmits its energy to the flywheel, which in turn drives the bullet back up the barrel. In the motor, the piston on its return stroke draws in a mixture of gas and air, which is compressed to a point, which renders it highly explosive; at this juncture the electric spark—corresponding to the cap in our simile, is flashed and explodes the gas, this gives the piston the impulse, which puts kinetic energy into the flywheel for returning the piston, besides doing the work required of the engine.

In the 4-cycle motor the charge is admitted to the cylinder and exploded, driving the piston to the end of the stroke—cycle 1. The momentum of the flywheel drives the piston back, during this period exhaust valves open and the spent gases are driven out of the cylinder—cycle 2. The energy still left in the flywheel drags the piston outward another stroke, during which inlet valves open and admit a new charge of explosive mixture—cycle 3. The flywheel again drives the piston back, compressing the gas ready for a new explosion—cycle 4.

In the 2-cycle motor the incoming gas is made to sweep out the old and spent gas and an explosion is obtained every revolution; it is not a good mechanical proposition but works well for small power, and as it does away with a number of valves at the attachments for operating them, the mechanism is simplified and first cost reduced.

The operation is this. The gas is admitted and exploded, driving forward the piston, at a point in the stroke the piston uncovers a port in the cylinder wall which permits egress of the exploded gas; another port on the opposite side is uncovered through which rushes new gas which had been confined under pressure, a deflector is cast on to the top of the piston which directs the rush of new gas to the cylinder head, whence it recoils with sufficient rapidity and force as to drive before it the spent gas without commingling with it to any appreciable extent; the return stroke of the piston compresses the new gas, which is then exploded and another impulse given to the piston.

It will be seen that the 2-cycle engine requires a lighter flywheel and considerably less mechanism than the 4-cycle, but it is not reliable for varying loads and will not stand up to continuous heavy work so long as the latter; also, it is less economical in fuel, as a portion of unspent gas must pass off with the exhaust. whilst a residuum of the latter remains in the cylinder, causing incomplete combustion by adulterating the explosive mixture.

REVERSING.—Generally, the engine is intended only to run in one direction; the astern motion being effected either by changing the angle of the propeller blades or by a reversing clutch. There are many forms of reversible propellers on the market, any of which may be applied. The reversing clutch consists of a train of gears, by means of which the direction of rotation of the shaft is reversed, and is identical with the arrangement used in motor cars. In practice, the solid propeller with reversing clutch has been found the more efficient of the two systems, but the noise made by the gearing is objectionable.

The engine itself will reverse if the explosion is timed at the right moment, if for instance the revolutions are in the direction of the hands of a clock and the spark is ignited at two minutes past 12, the piston receives its impetus and the crank revolves in the normal direction; if now on the return stroke the spark ignites at two minutes before 12, the crank will not turn the center and the piston is forced back, and as long as the spark occurs at this point the engine will run that way. In practice it was found that motors could be reversed by this means when running free, but not with a load on; so a releasing clutch has been devised which disconnects the shaft while the position of the sparker is being altered, it is thrown into gear when the engine starts to go in the direction required.

COOLING.—The heat generated in the cylinder is great and is usually dissipated by means of water circulating round it; in land engines circulation is obtained by gravitation, a cooling tank is placed a few feet above the engine, into which the hot water discharges, the cooler water returning to the jacket from the bottom of tank; for marine work a pump is necessary. Care must be exercised in frosty weather to see that jackets are drained when the engine is not being used. In very cold climates winged radiators cast on the cylinder are preferable to water cooling.

VAPORIZER.—As its name implies is an instrument for changing the liquid fuel to the gaseous form, it consists of a brass vessel containing a float and a needle valve, these are so adjusted that air is admitted in the exact proportion to the quantity of gasoline passing through the valve, in order to make the correct mixture for explosion. If an excess of gasoline is supplied the mixture is said to be "too rich," and either the cylinder is flooded with liquid gasoline and the electric terminals wetted, killing the spark, or incomplete combustion takes place and black smoke of offensive odor is emitted from the exhaust, and the working of the engine is weak and erratic: and if too much air enters the gas will not explode at all. An induced draught to the cylinder is created by the motion of the piston, and the gasoline is drawn through fine perforations in the vaporizer, which breaks it into a minute spray when the mixture with air takes place. Once the float-and-needle valve have been correctly adjusted they should not be interfered with except when atmospheric or temperature changes make re-regulations necessary. A butterfly throttle valve forms part of the device which is operated by a hand lever and the speed of the engine is thereby controlled.

SPARKING.—Although theoretically explosion will occur automatically when a given pressure and temperature agree with the right chemical combination, in practice all the precise conditions cannot be relied upon to insure regular action. An electric spark is utilized to ignite the gas; a plug containing insulated wires is screwed into the cylinder end. The terminals consist of two platinum points with a gap between of about 1/16 of an inch; the current is conducted through cables to the plug, first passing through the timer, this is a device operated by the engine which opens and closes the circuit, when the circuit is closed the electric fluid jumps the space between the terminals of the plug; and a spark is generated in the same manner as the arc light. By altering the position of the timer an early or late spark can be obtained and the explosion timed to

take place at the moment most suited to the conditions. Sometimes instead of the plug what is termed the "make and break" system is adopted, this is an arrangement whereby a reciprocating part of the engine causes a pawl to oscillate within the clearance part of the cylinder, on this is fitted a platinum point which bears against an electrode screwed through the cylinder cover or head, when the movement of the pawl breaks the contact with the electrode the current tries to follow and so create a spark. The heat and intensity of the spark is a most important desideratum. When two spark plugs are fitted to one cylinder much better combustion results, besides the advantage of increased reliability due to duplication.

ELECTRIC CURRENT.—Is generated in the first instance in a set of dry cells, or a battery of the Lalande type. Four cells of about 18 amp. make a good battery for a 3 H. P. motor; these are either placed in a convenient locker and connected in series, or the set can be obtained fitted into a box and encased with hard wax, this is a portable and watertight arrangement and very suitable for marine work on account of the perfect protection from damp and other destructive agents prevalent on board vessels. The life of dry batteries depends a great deal on weather conditions and changes of climate; they will not last longer than a few months, even when the motor is little used and not consuming current, and as they die practically of senility, it does not avail to carry spare cells, as they also will be found weak when wanted. Being cheap and easily replaced is in their favor when near sources of supply, but for remote places or long voyages a renewable battery is desirable.

The Lalande type consists of jars containing zinc and copper-oxide plates suspended in a solution of caustic soda, on this floats a thin layer of oil to check evaporation. These batteries retain their voltage until exhausted, and when it is necessary to renew the constituents it is an easy matter to remove the wasted metals and pour in fresh solution, the battery is then as good as new; renewals can be kept indefinitely as of course no chemical action takes place until they are combined.

For continuous working, a magneto or sparking dynamo is often fitted; the engine is started with current from the chemical battery and when fairly away this is switched off and the magneto brought into operation; the best way of driving this is by friction pulley bearing on the flywheel and held thereto by springs. Belts require constant tightening, and gearing is noisy.

THE COIL.—The current generated by the batteries is of low potential and has to be transformed into high tension in order to produce spark of the required intensity. The current is led by "primary" insulated cable to the coil, which gathers up electro-magnetic energy which is released when the vibrating points are separated: the "secondary" cable conveys the current thence to the spark plugs or electrodes within the cylinder. In multiple-cylinder engines special coils are required with terminals for each, or individual coils for each cylinder, the units being interchangeable.

LUBRICATION.—In all high-speed engines this is a most important factor. For the internal parts care must be taken that only best quality gas-engine oil is used, and the oil must be fed continuously. It passes through sight-feed lubricators and the drops can be regulated with the greatest nicety. An excellent method of feeding is where a reservoir, holding say, a quart, is fitted in a convenient corner having a pipe connection to the crank case, where always exists a slight pressure, this forces the oil up to the sight-feeds, and the amount admitted to the cylinder, etc., is regulated by stop cocks. The wrist pin passing diametrically through the piston is bored hollow, and gathers oil from the oil orifice in the cylinder wall as it passes. By this means not only the pin is lubricated, but the surplus oil flows down a channel in the connecting rod to the crank pin; the drippings from this fall into the crank case, which being hermetically closed retains it, and the crank splashes it over all working parts. In the two-cycle engine where the explosive vapor is drawn into the crank case previous to passing into the upper or working end of the cylinder, it becomes impregnated with atomized oil and arrests thereby the smooth running of the piston.

GENERAL.—When well cared for, few adjustments are found necessary in well-designed motors, and they will run a long time before requiring overhaul. The thrust of the propeller shaft is taken by ball rings on the bedplate; bronze alloys are more suitable for bearings than white metal. The connecting rod in the smaller sizes is of bronze throughout, of H section; the nuts should be very securely locked and pinned: the piston is very deep, having three Ramsbottom rings above and one below the wrist-pin. A muffler is necessary to drown the sound of exhaust, some engines exhaust under water, but the back pressure somewhat checks the speed. A governor fitted within the flange of the flywheel is a useful adjunct, though not always supplied, many makers contending the single cylinder engines are so carefully balanced as to render governors unnecessary. Multiple engines have the turning moment well distributed; this, however, does not prevent racing and launches carried on ocean steamers do not always have smooth water to sail in.

In all parts of the world where gasoline is procurable at a reasonable price the internal combustion engine is dsplacing steam for small craft. It is not necessary to recapitulate its advantages and the objection formerly adduced that it is not perfectly dependable is answered by the fact that motor boats have crossed the Atlantic under their own power and without convoy, and motor engines are being fitted into lifeboats, which have provision for self-righting in case of capsize. The engine being enclosed in a watertight compartment and manipulated from the outside by means of rods and handles passing through stuffing boxes in the bulkhead; an engine that will comply with such conditions has surely come to stay.

BERING SEA REVENUE CUTTERS.

The Bering Sea fleet, consisting of the revenue cutters Thetis, Bear, Perry, McCulloch, and Rush, under command of Senior Capt. F. M. Munger, having completed its duty in Alaskan waters, the vessels have been ordered to their respective stations. The Bear arrived at Valdez, Alaska, Sept. 25, for the purpose of prosecuting two Japanese schooners seized by her during the summer.

The work of the fleet this year has been exceptional. Aside from successfully guarding the seal islands and territorial waters and preventing raids other important work has been done.

The Perry made an important investigation of the condition of the natives along the Aleutian Island chain as far west as Attu, the McCulloch went to the relief of vessels caught in the ice in the vicinity of Nome, and the Rush made an important survey of Bogosolf volcano. In the Arctic the Thetis has done valuable work.

The combined fleet has cruised over 60,000 miles, boarded 27 of the 28 Japanese sealers, rendered assistance to distressed vessels amounting to nearly half a million dollars, and supplied many villages with food, clothing, medical and surgical treatment.

DEMONSTRATION OF MARINE GAS ENGINES ON THE MERSEY.

The application of gas as a marine motive force will generally be regarded among engineers as having advanced another step by reason of the success of an important demonstration which was carried out on the Mersey recently by Messrs. William Beardmore & Co., Dalmuir, Glasgow.

They have for some time been engaged in the improvement and construction of a cylinder single acting gas engine, the work being under the personal supervision of William W. May and Andrew May Jr. Results, both in regard to economy and efficiency, were so satisfactory that by an arrangement with the admiralty, through the Marquis of Graham, it was agreed to install the plant in the Clyde Naval Reserve training vessel Rattler, which, as an old type of gunboat, had been equipped with horizontal machinery of the triple-expansion type, with two navy boilers.

A little while ago the Rattler, having been fitted with the new plant, commenced a series of coastal tours, under the command of the Marquis of Graham (commander of the Clyde Naval Volunteer Division) and a crew drawn from the Royal Naval Reserves and Volunteers.

By arrangement the Mersey was visited for the purpose of carrying out a demonstration, to which a number of interested gentlemen were invited. Among those present were: A. J. Maginnis, William Esplin Sr., John Esplin, J. Reney Smith, Professor Watkinson, A. Mackenzie, A. Wood, Hugh Nelson, G. Given, Captain A. B. Toms (marine surveyor), Mr. Gibson, J. Mackenzie, Mr. Ferber, J. A. F. Aspinall, W. H. Welsh, A. C. Hay, W. J. Bruce, Mr. Hurst (Lloyds surveyor), C. B. Nichols (British corporation surveyor), J. Crichton, C. Sinclair, C. Geddes, J. Grundy, Mr. Perraton, G. Thompson, Mr. Lambert, and others.

A trip was made to the bar lightship from the Sloyne, with results that were entirely satisfactory.

The engine, which has 500 I. H. P., was, as already stated, built by Messrs. William Beardmore & Co. It is a five cylinder single acting gas engine, with a cylinder bore of 24 by 24 in., the stroke running at 115 revolutions. The producer is a steel casing lined with fire brick, and is fed from the top with coal, 90 lb. being sufficient to maintain the horsepower indicated for one hour. As the coal is burnt away it is drawn out as ash, there being a thoroughly complete combustion. The gas is formed by air being drawn in through the bottom of the producer, which, having been decomposed, reaches the top of the consumer in the form of gas.

The gas is then brought into a cooling tower, where it is met by a series of water sprays, and thus cooled and cleared of dirt. From this tower it passes to a centrifugal dryer. This consists of a fan revolving at a high rate of speed in a chamber. The gas, being lighter, remains in the center of the dryer, and the high rate of speed of the blades throws the water and grit to the sides, and passes to a water seal. The cleaner into which the gas is drawn consists of a cast iron box, on the side of which is a series of baffle plates. The gas on its passage through impinges against the plates, and leaves behind any remaining water or grit. Thence the gas passes to the mixing valve and to the main gas pipe for distribution among the five cylinders.

On the gas being drawn into the cylinders it is compressed and fired by a magneto, the sparking plug being of the make-and-break type. The exhaust gas is treated by means of an exhaust drum. In this there is placed a nest of tubes, through which water is circulated. The steam generated from the cooled exhaust is used, and a supply of hydrogen secured for the gas. The exhaust drums, it may be added, also act as silencers. It may be mentioned that the difficulty of the engine not reversing is overcome by a reversing clutch, which practically acts instantaneously.

Several special features of the installation were noted at yesterday's demonstration. It was shown that the fuel consumed represented 0.8 lb. of coal per indicated horsepower, while the machinery, weight for weight, is 25 per cent less than that of the old machinery.

There is also a very considerable saving of space, and by the abolition of the stokehold a great saving of labor. The whole staff engaged at the engines consists of three engineers and two firemen. The engine room and producer department are airy and cool.

The Rattler, under the handling of the Marquis of Graham, was maneuvered in various ways to show the ready adaptability of the engines, both in regard to turning, slowing down, and starting. The impression created was highly favorable, the general verdict being that the suction gas engine had come to stay.

During the afternoon Mr. A. J. Maginnis, on behalf of the guests, proposed a vote of thanks to the Marquis of Graham and to Messrs. Beardmore & Co., coupling with the latter the name of Mr. May. He say they had seen that day the initial stage of a great scientific revolutionary force, which within a comparatively short space of time would make itself felt in the mercantile marine. It was pleasing to note that at the head of this important advance movement they found, as in many other similar cases, a member of the British aristocracy. Both Mr. William May and Mr. Andrew May were to be congratulated upon the splendid attainment which they had accomplished with the engine, which had that day given such satisfactory results. [Applause.]

The Marquis of Graham, who was warmly greeted, acknowledged the compliment. He said he was pleased to have assisted them in the experience of that day, and he thought they might say, what few could aver, that they had been gassed down the Mersey. [Laughter.] He had little doubt that when more heads had been at work on the idea the suction gas engine would find an important place. [Applause.] He did not think there would be anyone more grateful for this than engineers, shipmasters, and shipowners. He agreed with Mr. Frank Bullen, in one of his articles, that if they succeeded—as they were doing—in abolishing the stokehold they would have accomplished a great work. [Applause.]

After the visitors left the Rattler she resumed her tour, proceeding to Arran.

CIRCULAR ON REVISED STEAMBOAT STATUTES.

The department of commerce and labor has recently published a circular known as Bureau Circular No. 8 which contains "Sections of the Revised Statutes and Rules and Regulations Relating to Licensed Officers of Steamboats."

It is the desire of the department that this circular shall come into the hands of as many licensed officers of steamboats and steamboat owners as possible and the board of inspectors at Cleveland is therefore prepared to supply a copy to all licensed officers who will forward their addresses or call at the Cleveland office. Owners of steamboats which have been inspected in this district will receive copies by mail.

BATTLESHIP ENGINES.

A letter from Horace See in a recent issue of the *Army and Navy Journal,* is interesting, coming as it does so soon after the recent accident to the Cunard line steamship Mauretania in which she lost one of her turbine driven propeller blades in a rough seaway. He says:

"It is interesting to note in a report of the meeting of the British Association for the Advancement of Science at Dublin the following expression of Sir Wm. H. White, a member of the Cunard committee under which the Lusitania and Mauretania were built:

"'The combination of reciprocating engines and turbines marked the beginning of a great revolutionary change. The constant desire of owners to reduce the coal bill would lead to this arrangement coming into general favor, and in addition to the boats now being built at Belfast, Messrs. Denny, he might add, were also adopting the system. The latter firm, it should be mentioned, had taken throughout a leading part in the application of the steam turbine to marine work.'

"The opinion of one who has had such a large experience in connection with the development of the turbine engine, as well as the decision of Messrs. Denny to adopt the combination, should have some weight with our navy department in designing the new battleships. The reduction of the coal bill not only means a saving of fuel per horsepower, but also obtaining more power per pound of coal and thereby increasing the mileage without enlarging the capacity of the bunkers. Mr. Stoney, whose paper called forth the remarks quoted above, stated: 'By using the reciprocating type for the high pressure portion of the expansion, and the turbine for the low pressure part of the range, where the volume to be dealt with was large, a combination was obtained which had an economy of 15 per cent over that of the best reciprocating marine engine. In the combination the reciprocator would expand down to atmosphere, and the remainder of the work could be done in the turbine. The two components of the complete plant might be arranged in different ways; but on the ships now building the reciprocating engines would drive the wing shafts, and discharge into a single low pressure turbine driving a central shaft.'

"The crippling of the Mauretania during her late voyage calls attention to a feature of the turbine that has seemingly been overlooked—that of the racing of the propellers when the stern has been lifted out of the water—a racing which must be more violent than with the reciprocating engine as the flow of steam to the turbine is uninterrupted and not stopped as in the case of the former with each stroke of the piston. It is not difficult therefore to imagine that when the stern is lifted the turbine will fly around at a high velocity—carrying with it the screw propeller, which, when the stern descends, may strike the water with a force sufficient to break off the blade which first enters the water and possibly wreck the shaft. An examination of the plans of this vessel show that great care has been exercised in regard to supporting and taking care of the shafting, as the bearings have been kept quite close together. The matter of retarding the racing, however, is one far more difficult and as it involves the personal equation it naturally suggests that the flow of steam was not throttled at the proper moment."

BOSTON WANTS A DRY DOCK.

The Boston Chamber of Commerce is behind a scheme for urging the state legislature to appropriate $800,000 for the construction of a dry dock capable of handling the largest ships, with the management to be in the hands of the harbor and land commissioners.

Mr. Jerome Jones, who has been a leader for many years in advocating this improvement for Boston, and who is chairman of the Merchants' Association committee in charge of the matter, thinks that the dry dock is bound to come on its merits. He says:

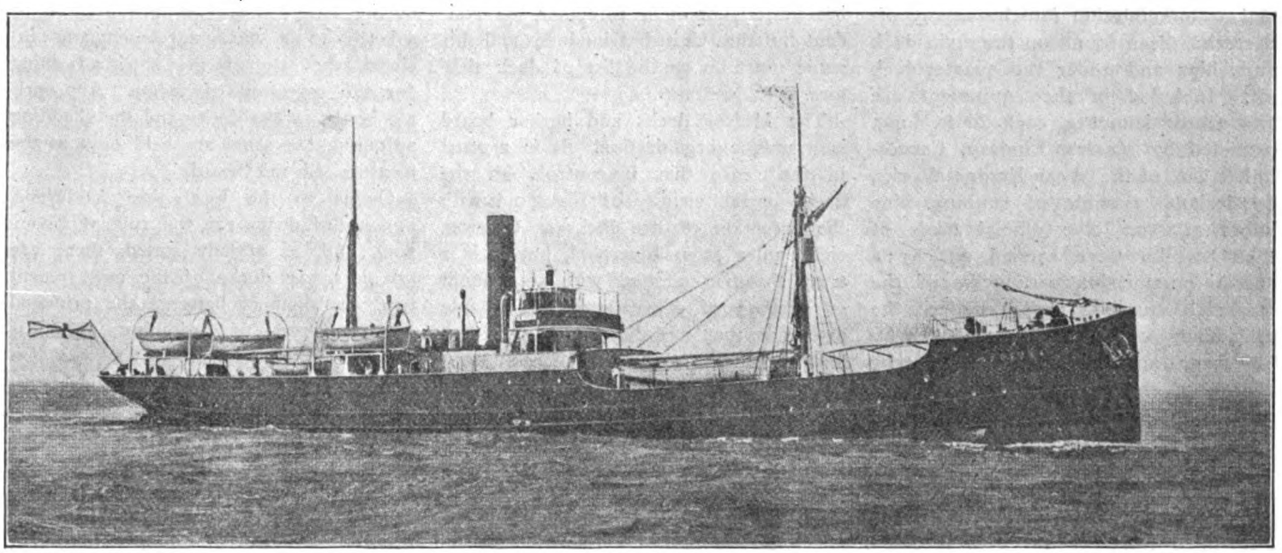
"There is no chance of such a dry dock being built by private enterprise, and we must go to the state. The state stands committed to transportation enterprises. It built the Hoosac Tunnel, the Commonwealth docks, and there is no reason why it should not found the dry dock, which is so badly needed here.

"I have been quoted as saying that I believed a drydock would be a paying investment. I never said so, because I doubt if it would. I do not think it would pay dividends for some time anyway. I do not think it would be a paying investment for the port in a general way because of the increase of business it would bring to our commercial and industrial interests. Transportation is the important and underlying factor in a great port. With this added facility more large foreign steamship lines would come here, creating new competition in transportation by sea and by land, which would cheapen the cost of freight in Massachusetts, and also the export cost of our produce and the finished products of our varied industries.

"We must compete with Montreal, New York, Philadelphia and Baltimore and the Gulf ports. How can Boston go to new lines and say, 'We have an attractive port and you should make Boston an important terminal,' when we have no way of taking care of their ships if they get into a serious disaster?

"Any Cunard or White Star or Hamburg captain will ask: 'Why don't you have a modern drydock for us in case we come in disabled from collision or other disaster?' I believe that when Boston offers the shipping of the world every facility it can find in any other port it will get a larger share of business than it does now. I am optimistic in regard to Boston's future as a port. I believe that she will have a larger trade in the future than she has had in the past, and we must be ready to handle it properly.

"The new drydock must be large enough to accommodate any vessel. We don't want a 600-ft. dock, because modern steamers are being built 700 and 800 ft. long. We want a drydock 900 ft. long or thereabouts so that we can take in the Lusitania if necessary, and repair her as well as it could be done in New York. We are not particular as to the location of the dock, there are locations in South Boston and East Boston, but we want such a dock somewhere. Our present idea is to have the dock in control of the harbor and land commission, or it might be managed in some other way. Let us have every facility for steamship traffic and no steamship line can afford to neglect us. Dock rentals are very low in Boston as compared with New York, and goods can be discharged easily. Adding a first-class graving dock to our local equipment would cause most of the lines to pay us attention. The dry dock would be merely an addition, a necessary piece of furniture to our furnished port. The drydock could probably be built for about $800,000. It is not likely that it will pay dividends for a number of years, but if it increases the business of the port it will have done its part. There is no reason why Worcester or Berkshire county should oppose this project. Increased business for Boston means increased business and prosperity for them. In a short time the national government will have increased the depth of the harbor so that it will

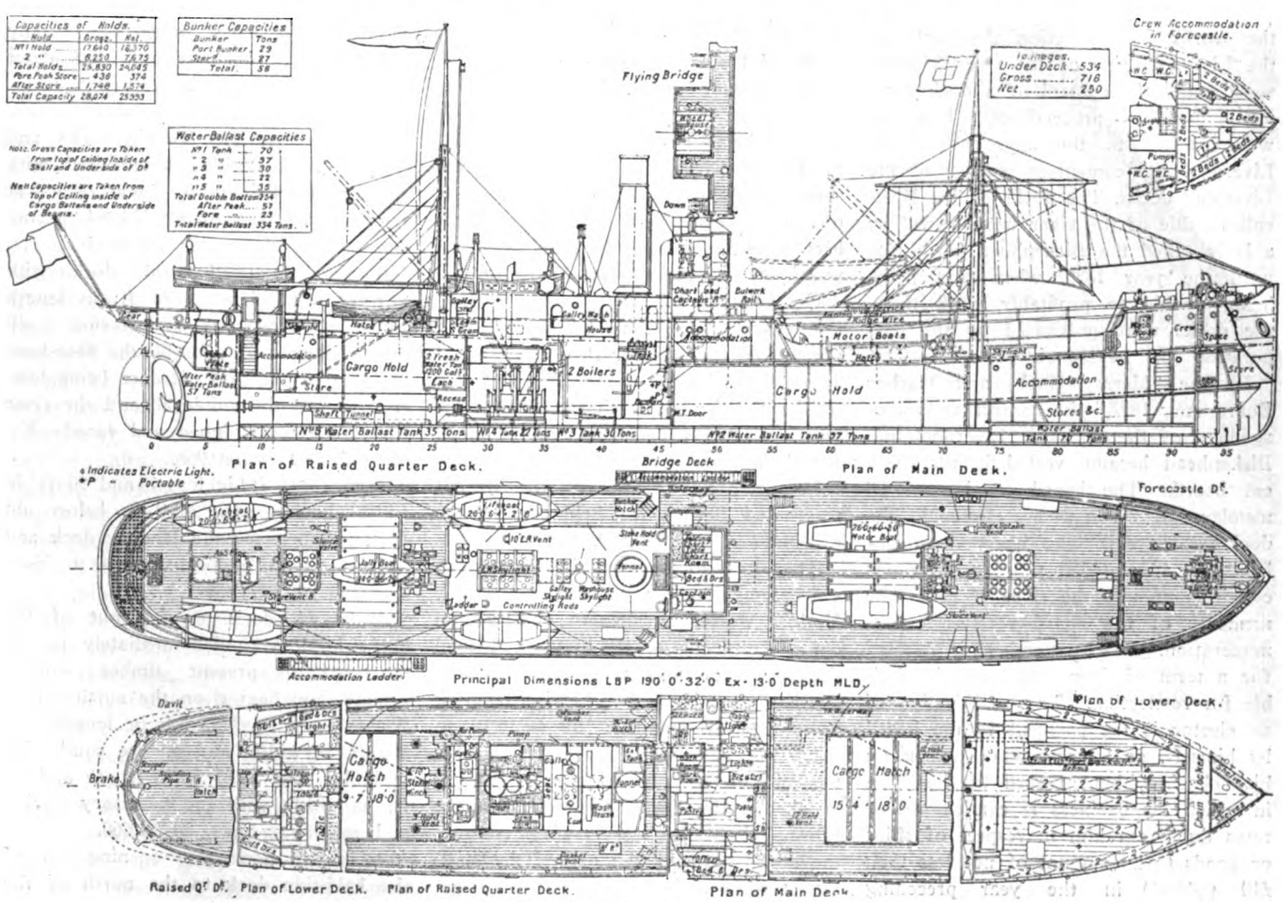


THE RUSSIAN SURVEY STEAMER OXOTCKB.

float the largest ship in the world. Let the port be ready for the harbor."

A SURVEY STEAMER FOR THE RUSSIAN GOVERNMENT.

There has just lately left the river Wear for Vladivostock the steamship Oxotckb, built by the Sunderland Ship Building Co., Ltd., for survey purposes of the Russian government. The Oxotckb, which has a length between perpendiculars of 200 ft., a breadth of 32 ft., and a depth molded of 13 ft., takes the highest class in the British Corporation, and was built under special survey. The engravings clearly illustrate the dimensions and design of the vessel. The main engines, provided by Messrs. G. T. Gray & Co., of South Shields, have cylinders 14 in., 23 in., and 38 in. by 27 in. stroke, steam being supplied by two large boilers, working at a pressure of 180 lb. per sq. in. The vessel has water ballast fore and aft. When in full commission, a technical staff and crew of about 85 persons will be carried,



DETAILS OF THE RUSSIAN SURVEY STEAMER OXOTCKB

and accommodation for the survey officers has been found on the main deck amidships and under the quarter-deck aft. Included in the equipment are two motor launches, each 26 ft. long, provided by Messrs. Lindsay, Carverhill & Co., of the Wear Engine Works, Sunderland, capable of running nine knots at sea. The official trials of the Oxotckb were carried out by a special commission of officers of the Imperial Russian navy, under the presidency of Capt. Stetsenko, who has been appointed shortly to take charge of the Russian cruiser Rurik, now being built by Messrs. Vickers, Sons & Maxim at Barrow.

LIVERPOOL DOCKS.

Consul John L. Griffiths, of Liverpool, gives a review of the development and management of the extensive dock and wharf system in and around Liverpool. In part he writes:

The whole of the dock system of Liverpool, including docks, quays, sheds, dredgers, cranes, warehouses on the dock estate for the storage of goods, and the railway track along the line of docks, is owned by the Mersey docks and harbor board as public trustees. The pilot service of the port is also controlled by the dock board. Prior to the year 1857 the docks, and the works in connection therewith on the Liverpool side of the river Mersey, were under the control of a dock committee whose proceedings, however, were subject to the approval of the Liverpool city council as trustees of the Liverpool docks. The docks on the Birkenhead side of the river were owned by a body called the Birkenhead Dock Co., until the year 1856, when that body, being unable to profitably work them, the docks were purchased by the corporation of Liverpool.

By the "Mersey Docks and Harbor Board Act, 1857," the control and management of the docks at Liverpool and Birkenhead became vested in the present board. The board consists of 28 members, of whom 24 are elected by the dock rate payers. The other four members are appointed by the conservancy commissioners of the river Mersey. The members of the board receive no remuneration. Each member is elected for a term of four years, and is eligible for re-election. The qualification of an elector is the payment to the board by himself, or by any other person on his behalf, without regard to the place in which his business is carried on, of rates due from him in respect of ships or goods to an amount of not less than £10 ($48.60) in the year preceding August. He must, however, be a British subject, or if a foreigner, be resident in the United Kingdom, and his name must be on the list of dock electors.

The Mersey docks and harbor board is a unique organization. It is a trust in the sense that it controls all the docks in the vicinity of Liverpool with the exception of the docks at Garston, eight miles from Liverpool, but it is a trust that is operated without thought or purpose of private gain. The only dividends that it declares are expressed in the growing prosperity of the port.

The management of this trust has been so efficient that it has met not only with the approval of the municipality of Liverpool, but has attracted wide attention throughout the United Kingdom, and to such an extent that the bill now pending in parliament, known as the port of London bill for the reconstruction and reorganization of the dock system of that city, is modeled on the Liverpool plan.

The dock board receipts for the year ending June 30, 1908, were as follows:

Rates on vessels—	
Tonnage and harbor rates	$3,355,898
Graving dock and gridiron rates	189,156
Dock rent	41,597
Total rates on vessels	$3,586,651
Rates and dues on goods—	
Dock rates	$1,720,319
Town dues	1,459,618
Total rates and dues on goods	$3,179,937
Grand total receipts	$6,766,588

The money required for the construction of docks and other works is obtained by borrowing powers authorized by acts of parliament. Large sums are spent upon the docks from year to year out of revenue, and it has therefore been found impossible to state, even approximately, what the total cost of the docks amounts to.

A charge of 60 cents per square yard per annum is made for shed space at all appropriated berths on the Liverpool side of the Mersey, and a charge of 48 cents per square yard per annum is made for shed space at all such berths on the Birkenhead side of the river. All appropriated berths are held during the pleasure of the board.

There are no piers at Liverpool which are used similarly to those at New York. Vessels arriving at Liverpool enter the docks to discharge and load their cargoes and use the Liverpool landing stage to embark and disembark passengers, if required.

No special charge is made for the use of the landing stage by vessels which use the docks, the dock tonnage rates paid on the vessels when entering the docks covering the use of the landing stage.

The dock sheds are built and owned by the dock board. The appropriation of a berth to a particular company includes the use of the shed adjoining for the reception of cargo. Appropriate berths in the docks and the shedding adjoining the same are held only at the pleasure of the board.

Owing to the local tide conditions, impounded docks are the rule at Liverpool, and, as already stated, there are no piers. In docks of the most recent type, the distance between the principal parallel quays of adjoining docks is about 280 ft., taken up as follows: On each quay sheds about 95 ft. wide, with outer quay margin of 5 to 8½ ft., the balance of width forming a roadway between the sheds. The sheds are of double stories, with large headroom on ground and upper floors, very substantially constructed of steel, slated roof, ground floor of granite cube sets on concrete foundation, upper floor of concrete on steel rolled joists having a hard top surface of granolithic concrete.

The cranes for discharging cargo are carried on the roof of the dock side span of shed, and there are power delivery cranes on the roadside of the shed at the doorways, and appliances for lowering from catheads there, in addition to others lowering through hatchways in the inside of the shed. The modern dock quay walls are solidly constructed of concrete and cost about $632 per linear yard.

PROPOSED NEW DOCKS.

In May last the Mersey docks and harbor board decided to proceed with the construction of the new docks at an estimated cost of $15,573,384, particulars of which are as follows:

A vestibule or half-tide dock, with a river-lock entrance 870 ft. in length and 130 ft. in width, and having a sill 30 ft. below old dock sill, the foreshore in front of the said entrance being lowered to suit the sill level, and the river wall being underpinned and faced. Estimated cost, $6,700,968.

A lock 645 ft. in length and 90 ft. in width, having sills 20½ ft. below old dock sill, between the Hornby dock and the new half-tide dock referred to. Estimated cost, $994.356.

A branch dock opening out of the half-tide dock, and immediately to the north of the present timber storage ground, and having on the north side a double-story shed, 1,295 ft. in length and 100 ft. in width, and on the south side a similar shed 1,465 ft. in length and 150 ft. in width, with the necessary paving and railway sidings, $4,281,660.

A branch dock also opening out of the half-tide dock to the north of the branch dock, and having on the north

side thereof a double story shed 1,265 ft. in length and 100 ft. in width, and on the south side a similar shed 1,295 ft. in length and 100 ft. in width, with the necessary paving and railway sidings, $3,006,400.

BUILDING FOR THE FUTURE.

The chairman of the dock board, when introducing the scheme for ratification by the board, said:

"In 1887 the largest ships leaving the port were 560 ft. long; in 1897 the ships had grown to 625 ft., and last year the largest ship was 760 ft. The amount of money involved by the scheme was a substantial one, but it had to be borne in mind that the spending of this money would be spread over a number of years. He did not think it possible that the docks could be made in less than five or six years, and it might take a little longer time; consequently, if the sum were divided into five or six, it did not seem so serious.

"It was proposed to make the entrance lock 40 ft. below the old dock sill. The river entrance lock would be 870 ft. long, 130 ft. wide, with a sill 30 ft. below the old dock sill, which meant that on a 10-ft. tide, the lowest neap tide they had, there would be 40 ft. of water. In New York they were going to get 40 ft., in Mexico they were talking about getting 35 ft., and he understood that the engineer of the Suez canal had ambitions of having 36 ft. of water in that canal to enable men of war to go through, and vessels going to India and China which might, in the course of a few years, want 40 ft. The board ought to have no hesitation in accepting the depth proposed in the scheme."

The World's Dreadnoughts.

Alan H. Burgoyne, editor of the *Navy League Annual*, London, has contributed the following article on the world's Dreadnoughts to the London *Times:*

Sir—At a moment when the admiralty are considering the naval program for next year, it would not seem inopportune to chronicle in concise form the true position of the world in regard to ships designed and built since the initiation of that which is known as the "Dreadnought Era." Herewith I send you a copy of a table I have drawn up to be included in this year's *Navy League Annual*, and in it are set down all the known particulars of Dreadnoughts or Invincibles that will be built, completing, or on the stocks at the end of the present financial year—viz., March 31, 1909.

Before dealing therewith, however, it were well to clear the ground in regard to pre-Dreadnought ships. No one will deny that in vessels dating from the naval defense act of 15 years ago we have an overwhelming superiority, not only in the total number of units, but in their individual fighting power. Only the United States can claim to possess battleships comparable to our King Edward VII. class, whilst the latest German ships completed, the five Deutschlands, would not seem much superior to our far older Majestics. It is evident, therefore, that we began the new competition with a great deal in our favor—a magnificent and dependable "second" line. What is the situation today? From the appended table it will be seen that, though the Dreadnought was only laid down in the winter of 1905, just three years ago, no less than 45 units of similar or greater strength are now building for ourselves and other nations. The meaning of this is obvious; that rather than checking naval construction, the advent of the new type has proved an additional incentive to even greater efforts. For the Dreadnought, though she does not (as injudicious critics are too fond of insisting) drive all vessels of earlier date into immediate obsolescence, has at least initiated a type which must obviously be possessed in considerable numbers by any nation desirous of maintaining an honorable position upon the seas. My list may be criticized by reason of the inclusion of the Lord Nelson and Agamemnon. But I hold, and have a mass of expert opinion to support my contentions, that these two ships are fully the equal of the French Dantons or the United States Michigan and South Carolina. The former vessels, it is true, have an extra 9.4-in. gun on each broadside, but their protection is certainly not equal to that of the British ships. The Michigan fires a similar broadside to the Dreadnought —i. e., eight 12-in. B.—but her belt is not continuous, nor is the armor as thick or so generally distributed over the side of the hull; the speeds are identical. Also, whereas the eight 12-in. guns of the Michigan form her entire armament, the Lord Nelson, while presenting four 12-in. B. and five 9.2-in. B. guns to an enemy, always retains a further five 9.2-in. B. in reserve on the opposite broadside; and the 9.2-in. gun, firing a 380-lb. shell, is not to be despised. I exclude, too, the German 14,760-ton armored cruiser Blucher; she is not a Dreadnought, but an intermediate built under misapprehensions as to the power of our Invincibles. In the three Minotaurs and six Warriors we have ships nearly, if not quite, her equal.

The general public accepts a ship, on her launch, as a direct addition to the fighting strength of the power to which she belongs. Certain sections of the press, unfortunately, cater for such ignorance, and the result is a series of contradictory statements or figures, either proving us far too strong or else showing the fleet to be in the last stages of numerical decadence. A ship possesses no practical value until fit to fight—from truck to keelson she must be a finished article, and only in completed ships is it fair to make comparison. These comparisons, even so, can quite well be extended into the future for the purpose of showing how we shall stand as against other nations in three years' time.

Classing Dreadnought battleships and battleship-cruisers as one—for the latter possess higher speed at some sacrifice in protection — we should on March 31, 1909, stand as follows:

Great Britain	9
Japan	2

Obviously no ground for adverse comment exists here, for no other nation will have a single vessel of the Dreadnought type complete; and the fact that for some years yet Japan is our ally should not be lost sight of. On March 31, 1910, the figures should have become the following:

Great Britain	12
Germany	4
Japan	4
U. S. America	2
Brazil	2

The most adverse critic of admiralty policy could find little fault with these figures. Our superiority is crushingly obvious, for we shall have as many Dreadnoughts complete as all the other powers combined. At the end of another 12 months, a striking change becomes noticeable. In March, 1911, the totals should be:

Great Britain	14
Germany	9
Japan	8
U. S. America	4
Brazil	3
France	2

The British movements from this date are not known, for our figures in March, 1912, will be augmented by such vessels as are laid down under the estimates for 1909-1910. For the other nations, the totals will be something as follows:

Great Britain	14+1909-10 program
Germany	13
Japan	10 or more
U. S. America	6
France	4
Brazil	3
Italy	1 or 2

The two chief deductions to be drawn from the above figures are obvious—(1) we are in a safe position until March, 1910; (2) from that date onwards we shall have to meet an annual addition of four units to the German and two (perhaps more) to the United States figures, or a total of (at least) six vessels to the navies of the two next strongest powers. In March, 1912, Germany and the United States will possess 19 completed Dreadnoughts or Invincibles; this can be neither gainsaid nor contraverted. To equal this total we must lay down five ships next year; we shall then, in the new type of vessel, be level with the two-power standard. Are we to have our 10 per cent margin of superiority in these ships? If so, seven is the minimum that can be accepted.

It may be argued from the table, and I am ready enough to admit the same, that every German ship has so far been very seriously delayed in her construction. This will be the better realized when I mention that German warships are supposed to be commenced in July of the year in which they are voted. Were this

THE WORLD'S DREADNOUGHTS.
BUILT AND BUILDING IN MARCH, 1909.

	Name.	Displacement.	Designed Speed.	Laid Down.		Launched.		Completed.		Notes.
	GREAT BRITAIN. (Contract time of building, 24 months.)	Tons.	Knots.							
1	Agamemnon	16,500	18.5	Oct.,	1904	June 23,	1906	June,	1908	1904 Naval Program. Contract time, 36 months.
2	Lord Nelson	16,500	18.5	Nov.,	1904	Sept. 4,	1906	Nov.,	1908	
3	Dreadnought	17,900	21	Oct.,	1905	Feb. 10,	1906	Oct.,	1906	1905 Naval Program. Contract time for Invincibles, 30 months.
4	Inflexible	17,250	25	Feb.,	1906	June 26,	1907	July,	1908	
5	Indomitable	17,250	25	March,	1906	March 16,	1907	July,	1908	
6	Invincible	17,250	25	April,	1906	April 13,	1907	Oct.,	1908	
7	Bellerophon	18,600	21	Dec.,	1906	July 27,	1907	Dec.,	1908	1906 Naval Program.
8	Temeraire	18,600	21	Jan.,	1907	Aug. 24,	1907	Jan.,	1909	
9	Superb	18,600	21	Feb.,	1907	Nov. 7,	1907	Feb.,	1909	
10	St. Vincent	19,250	21	Dec.,	1907	Sept. 10,	1908	Dec.,	1909	1907 Naval Program.
11	Collingwood	19,250	21	Feb.,	1908	Nov. 7,	1908	Feb.,	1910	
12	Vanguard	19,250	21	April,	1908	Jan.,	1909	March,	1910	
13	Foudroyant	20,000(e)	21	Jan.,	1909	Building		Nov.,	1910(e)	1908 Naval Program.
14	B	19,000(e)	25	Feb.,	1909	Building		Dec.,	1910(e)	
	JAPAN.									
1	Satsuma	19,250	20	May,	1905	Nov. 15,	1906	Jan.,	1908	
2	Aki	19,780	20.5	March,	1905	April 15,	1906	Oct.,	1908	
3	Battleship "A"	20,750	20.5	Dec.,	1907	Building		Dec.,	1909	
4	Battleship "B"	20,750	20.5	Dec.,	1907	Building		July,	1910	May be completed in 24 months from date of commencement.
5	Haki	18,650	25	May,	1907	Building		Jan.,	1910	
6	Cruiser "B"	18,650	25	Oct.,	1907	Building		July,	1910	
7	Cruiser "C"	18,650	25	?	1908	Building		Feb.,	1911	
8	Battleship "C"	20,750	20.5	?	1908	Building		March,	1911	
	U. S. AMERICA. (Contract time of building, 36 months.)									
1	Michigan	16,000	18.5	July,	1906	May 26,	1908	June,	1909	Authorized 1905.
2	So. Carolina	16,000	18.5	July,	1906	July 11,	1908	July,	1909	
3	North Dakota	20,000	21	Oct.,	1907	Building		June,	1910	Authorized May, 1907.
4	Delaware	20,000	21	Oct.,	1907	Building		Aug.,	1910	
5	Utah	20,000	21	Nov.,	1908	Building		Aug.	1911	Authorized May, 1908.
6	Florida	20,000	21	Nov.,	1908	Building		Aug.	1911	
	FRANCE.									
1	Danton	18,027	19	Feb.,	1908	Building		Jan.,	1911	1906 Naval Program. Commencement of all six vessels much delayed.
2	Mirabeau	18,027	19	April,	1908	Building		Jan.,	1911	
3	Voltaire	18,027	19	June,	1907	Building		July,	1911	
4	Vergniaud	18,027	19	July,	1907	Building		July,	1911	
5	Diderot	18,027	19	?	1908	Building		July,	1912	
6	Condorcet	18,027	19	?	1908	Building		July,	1912	
	GERMANY. (Contract time of building, 33 to 36 months.)									
1	Nassau	17,679	19	July,	1907	March 7,	1908	Oct.,	1909	1906 Naval Program.
2	Westfalen	17,679	19	July,	1907	July 1,	1908	Nov.,	1909	
3	Rheinland	17,960	19	Aug.,	1907	Sept. 26,	1908	Feb.,	1910	1907 Naval Program.
4	E. Baden	17,960	19	Aug.,	1907	Nov.,	1908	March,	1910	
5	Cruiser "F"	18,700	25	March,	1908	Building		Aug.,	1910	
6	E. Oldenburg	19,000(e)	20	Oct.,	1908	Building		March,	1911	1908 Naval Program.
7	E. Siegfried	19,000(e)	20	Oct.,	1908	Building		March,	1911	
8	E. Beowulf	19,000(e)	20	Oct.,	1908	Building		March,	1911	
9	Cruiser "G"	20,000(e)	25	Oct.,	1908	Building		March,	1911	
	ITALY.									
1	Mirabello	18,302	23	June,	1908	Building		Oct.,	1911	Two more projected.
2	"B"	18,302	23	?	1909	Building		June,	1912	
	BRAZIL.									
1	Minas Geraes	19,250	21	?	1907	Sept. 10,	1908	Jan.,	1910	
2	San Paulo	19,250	21	?	1907	Jan.,	1909	Jan.,	1910	
3	Rio de Janeiro	19,250	21	Nov.,	1908	Building		?	1911	

Besides the above there are projected:
For Russia, four ships of 24,000 tons and 21½ knots speed.
For Argentine, three ships of 16,500 tons and 20 knots speed.
For Chile, two ships of 19,000 tons and 21 knots speed.
For China, three ships of 21,000 tons and 20 knots speed.

Note—(e)=estimated. French and Italian dates of completion will probably be considerably surpassed.

rule maintained, the 30 to 33 months' period of construction in Germany would equal the fictitious British 24 months, since our vessels are seldom laid down until the close of the financial year—i. e., December to March. These delays in Germany have even yet not been mastered, and, at the time of writing, no signs of commencing this year's ship are evident at Wilhelmshaven, nor has cruiser "G" been started at the yard of Messrs. Blohm & Voss, of Hamburg. The date given—October—is, therefore, probably a too early estimate, and the date of completion will be extended accordingly. One of the chief delays in German ship building is due to the difficulty of obtaining guns in sufficient quantity; Krupps hold the secret of Teuton naval expansion and, did space permit, the struggle to fit in the many contending elements would make good reading. All this seems much to our advantage; but are we in any better plight ourselves? The Lord Nelson was commenced in November, 1904, and is just about to begin her official trials. She will certainly have exceeded four years from the date of laying down to the day she hoists the pennant with the home fleet. The Invincible and Inflexible should have been commissioned in May last; the former has not yet commenced her trials. The Defence—not a Dreadnought cruiser — will almost have created a record when she joins the fleet next year; she was laid down at Pembroke on Feb. 22, 1905. Why, too, are the ocean-going destroyers Afridi and Cossack not in commission when two ships of a subsequent program—the Amazon and Saracen—are already running their trials? Lastly, will the Bellerophon steam out of Portsmouth Harbor on Dec. 3 in commission and in all respects ready for service? It seems scarcely probable, since her trials are not to commence until Oct. 26. And if she is delayed, what shall be said of the Temeraire, at Devonport, or the Superb, at Elswick? These two will be fortunate if they see completion within 30 months.

The above statements prove conclusively that Germany has no monopoly of labor or other troubles; indeed, figures show that it is we who have been the greater sufferers in the past.

With these facts before us, the necessities of the future are easily grasped. This is written in no pessimistic spirit for there is not the slightest need for either panic or outcry. We are now, and shall be for some time, enormously strong. But the navy of today reflects the foresight of three years ago, and next year we have to look, not to our present position, but to that which will be presented in 1912. We have not the monopoly of misfortune, nor have we it of genius; our wonderful Dreadnought is powerful, but foreign copies are more so, and no longer can we claim that individual superiority will make up for lack of numbers. Battleships are cheaper than wars, and the present government will not lose in popularity if, to maintain our fleet at an efficient and sufficient level, it is forced to forego the much-promised economies in national expenditure. But, if it fail in its trust —it is not suggested it will do so— " * * * the wild mob's million feet

"Will kick it from its place,
But then too late—too late."

Your obedient servant,

ALAN H. BURGOYNE,

Editor of the *Navy League Annual*, 15 Southwick street, Hyde Park, W., Oct. 3.

GERMAN NAVY LEAGUE BILL.

A bill has been formulated by the German Navy League for presentation to the government, the particulars of which have just become known. The measure besides demanding an increase of $60,000,000, would raise the fleet's personnel by 5,000 officers and men. The program as formulated by the German Navy League is as follows:

1. The immediate construction of six large armored cruisers of Invincible or Indomitable class to replace six protected cruisers. (Under the present navy act the six protected cruisers would not be replaced until the years 1912-17.)

2. The increase of the high sea fleet from 16 to 17 battleships.

3. The provision of half crews for the 17 battleships of the German reserve fleet, instead of for only six battleships in that fleet, as at present.

The addition of six Indomitables would necessarily mean an enormous increase in the fighting strength of the German fleet, since these vessels are in everything but name extremely fast and powerful battleships. The cost of the six would be about $60,000,000, but the Navy League urges that, since money has to be borrowed to strengthen the fleet, it is just as easy to float a large loan as a small one.

Additional significance is given to the league's demands by the fact that its present head is Admiral von Koster. He replaced Gen. Keim to prevent a split in the league, and he is unquestionably in closest touch with the German naval authorities, since not only was he until two years ago the officer selected to command the German fleet in the event of war, but he is also now the confidential adviser of the German admiralty.

The following is a brief record of the recent German navy acts:

1906. The Novelle: (1) Size and cost of all German warships increased; (2) six large armored cruisers added; (3) number of destroyers laid down yearly raised from six to 12.

1907. Size and cost of German armored cruisers further increased.

1908. Number of large armored ships laid down annually for four years, 1908-11, raised from three to four, and annual expenditure increased from £14,300,000 to £22,400,000.

The position of the British and next strongest navies in ships of the Dreadnought and Indomitable types is as follows:

	England.	Germany.	United States.
Complete	2	0	0
Building	8	5	4
Sanctioned	2	4	2
To be laid down in 1909..	0	4	0
Total	12	13	6

TO REGULATE LENGTH OF TOWS.

A meeting is to be held in the office of the steamboat inspection service, Custom House, New York, on Nov. 9 and 10, at which the board appointed under an act of congress will formulate regulations limiting the length of hawsers between towing vessels and sea-going barges, and the length of tows on the inland waters of the United States. When these regulations have been approved by the secretary of commerce and labor they are to have the force of law and masters of towing vessels will be liable to the suspension or revocation of their licenses for willful violations of the regulations.

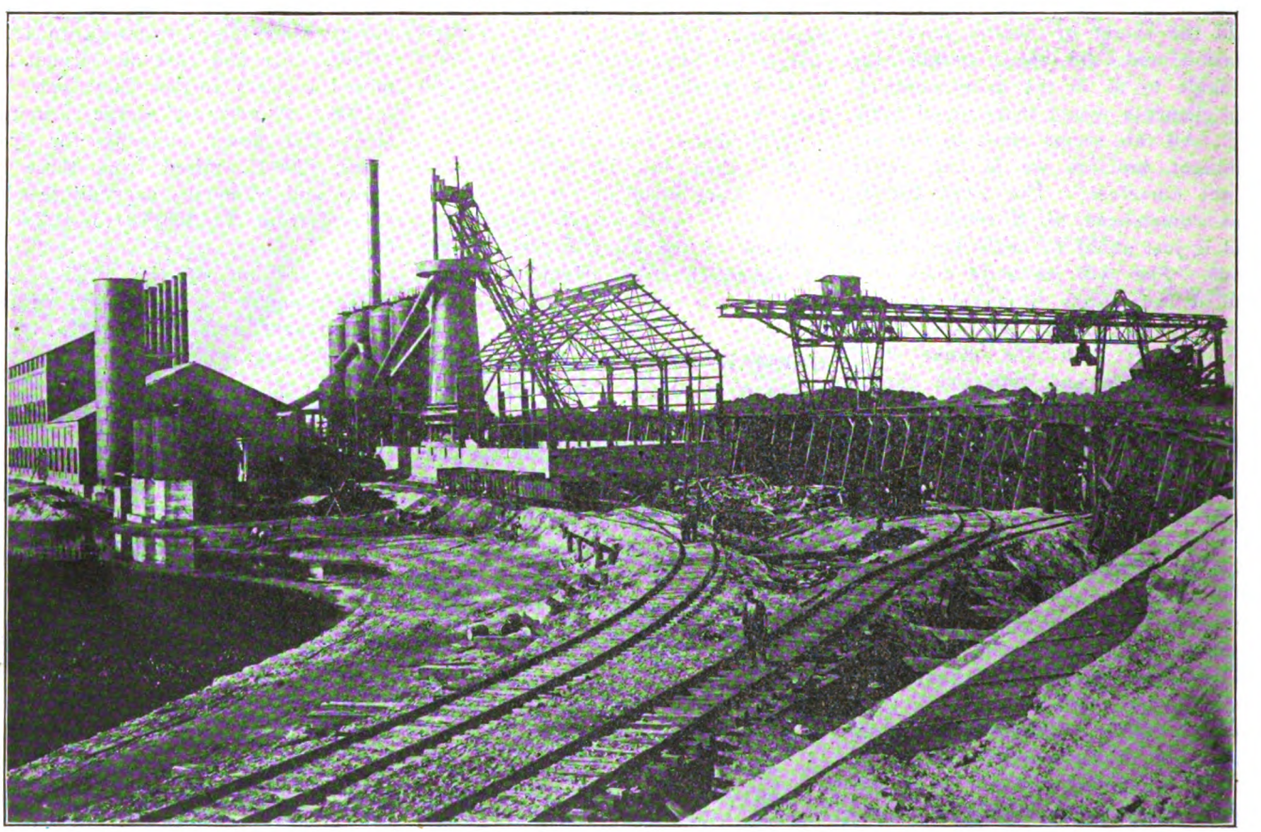
The board is composed of Rear-Admiral Marix, chairman of the lighthouse board; George Uhler, supervising inspector general of the steamboat inspection service, and Eugene Tyler Chamberlain, commissioner of navigation.

The New Blast Furnace Plant of The Wickwire Steel Company.

The first of the new industries to locate along the ship canal now being created in the Niagara river, which is the Wickwire Steel Co.'s blast furnace plant, began business Oct. 19. Inasmuch as the industry was among the first to answer to the call from the Niagara frontier, much interest is centered in the turning over of the machinery for the first time. The Wickwire Brothers Co., of Cortland, N. Y., a corporation controlled by similar interests, is a pioneer in the manufacture and development of the steel rod and wire industry. Its consumption of pig iron grew to such an extent that about two years ago the Wickwire management decided to build a furnace of its own. When the plans were worked out it was found advisable to construct a plant sufficiently large to furnish all the pig iron needed by the Cortland plant and to supply the trade. The Wickwire Steel Co. will, therefore, become a factor in the pig iron market. Arrangements have been made by the company with B. Nicoll & Co. of New York to place the surplus product, which will include all the grades of foundry iron used by the trade.

Eighty acres comprise the Wickwire Steel Co.'s site on the east shore of the Niagara river, with 1,500 feet of water front, between Buffalo and the Tonawandas, 1½ miles north of the Buffalo city line. The property has excellent shipping facilities, it being connected and crossed by the Erie canal and a spur of the New York Central railroad. The electric lines of the International Traction Co. pass the plant, giving direct connection with Buffalo, Niagara Falls and Tonawanda.

On Aug. 2, 1907, the first pile was driven for the new plant and in September of that year when the railroad tracks had been laid, the work of construction progressed rapidly. The plant is a typically modern affair, designed by Julian Kennedy, of Pittsburg, who also superintended the construction. Being located on the river, the furnace plant is approached by docks built by the company and equipped with all the essential machinery, such as Hulett ore unloading machinery, ore handling bridge, bins and skip hoists. The ore handling machinery was put to the first test June 27, when the initial cargo of ore was docked. It came down in the steamer Kensington—3,800 tons—this being the first large cargo of ore to pass down Niagara river, but a cargo of 6,000 tons soon followed on the steamer J. J. Boland. At present the Niagara river draught cannot exceed 14 feet 6 inches and the Wickwires have lately become interested with Boland & Cornelius, vessel owers of Buffalo, in a project to construct two steel ships which will be built along lines making heavy ore cargoes and light draught possible. These boats wil have an ore tonnage of 5,500 and 6,000 tons, respectively,



GENERAL VIEW OF WICKWIRE STEEL CO.'S BLAST FURNACE PLANT.

on a draught of 14 feet 6 in. When the Niagara river ship canal is completed, giving a 23-foot draught, these boats will carry their full tonnage.

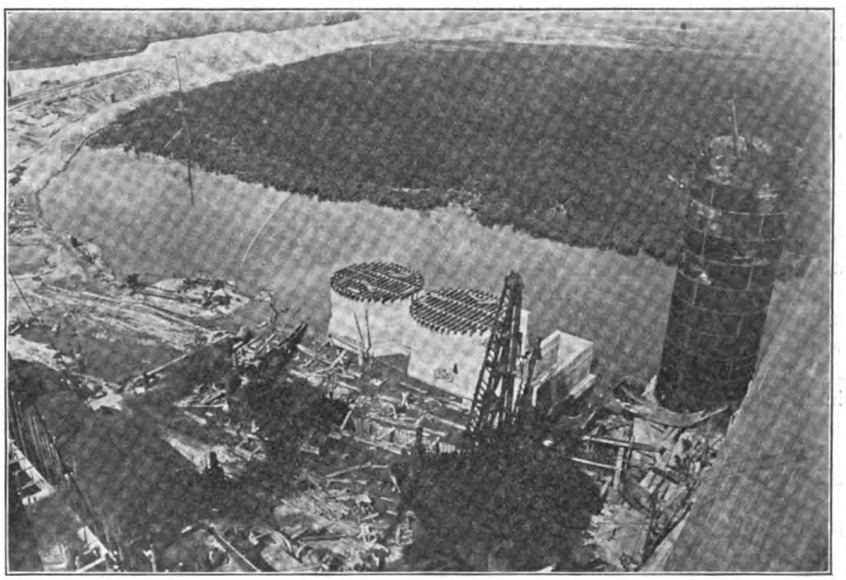
The blast is heated by four Kennedy central combustion stoves, each being 80 x 20 feet. A gas washer has been installed in connection with the usual dust catcher. The slag will be run into a granulating pit. A feature of the furnace will be a more than ordinary amount of cooling surface. There are 11 rows of cooling plates. It is figured that the furnace will have a daily output of 350 tons, basic, one-third of which will probably be consumed by the Cortland plant and the remainder sold to the trade. The Cortland plant has an open-hearth department now in operation.

Four batteries of two water-tube boilers each of a rated capacity of 350 horsepower, comprise the boiler equipment. As previously stated and illustrated in *The Iron Trade Review*, the blowing engine equipment consists of three Allis-Chalmers vertical engines with 96-inch blowing tubs. Two of these are high pressure engines. Two Harrisburg Foundry & Machine Co.'s Fleming slide valve engines have been installed to operate two Westinghouse 300-kilowatt generators.

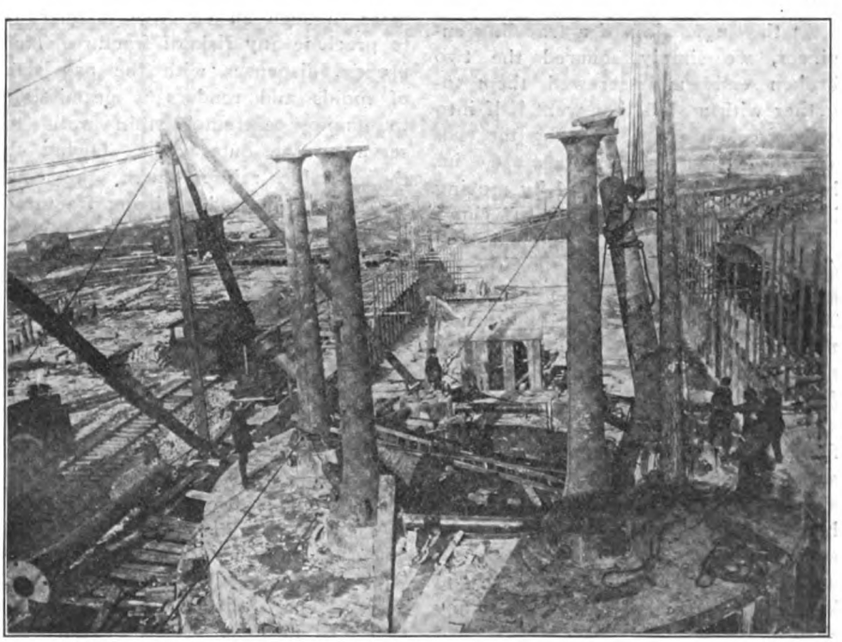
Water for the boilers is passed through a W. B. Scaife & Sons "We-Fu-Go" water softening and purifying system of 4,000 horsepower capacity. The general water supply system includes a 30-inch intake from the Niagara river, which opens into a well. Two Jeansville horizontal compound condensing plunger pumps are used in this service. The boiler feed pumps are of the same pattern. The condenser is of the Alberger barometric type. The pressure upon the water supply is obtained by a standpipe 20 x 80 feet.

The American Pig Casting Machine Co. built the cast house and the pig casting machine, the latter being a Uehling single strand, constructed by Heyl & Patterson, Pittsburg. The Variety Iron & Steel Works, of Cleveland, erected the structural and plate work in the building. The roofs of all buildings are covered with Federal cement tile.

The Cleveland Crane & Car Co. built the 25-ton electric crane for the power house and a 10-ton Brown Hoisting Machine Co. locomotive crane for conveying granulated slag and other heavy materials, also forms a part of the equipment. One-third of the company's water frontage of 1,500 feet is occupied by the ore dock, 500 feet in length. The dock is 200 feet wide and of reinforced concrete construction; 2-inch square steel rods tie the dock to the ore bin foundations. A 10-ton electric ore unloading machine is part of the dock equipment. Behind this machine there is a Brown Hoist 7½-ton bridge. Both machines are of new design. Three hundred tons of ore per hour can be removed from a boat by the Hulett machine.



FINISHING INTAKE OF WE-FU-GO WATER SOFTENING PLANT.



FURNACE FOUNDATIONS FROM TOP OF STOVES, JAN. 6, 1908.

The board of naval construction has submitted its recommendations concerning the chief characteristics of the two fleet colliers authorized at the last session of congress. The plans provide for a carrying capacity of 12,500 tons of coal. The engines of these vessels are designed to furnish a speed of 14 knots. One of the colliers is to be built at the Mare Island navy yard and the other by private contract. Proposals for the latter vessel are now being asked.

A QUICK METHOD OF REPAIRING A BROKEN SHAFT.

BY U. S. C. E. MEIGS.

The writer recently, almost by accident, hit on a method of repairing a broken shaft, so cheap, so quick, and so surprisingly strong that he thinks it may be of service to your readers. The use of the method would often obviate a long and expensive delay and loss of work, for the shaft gives nearly as good service as before it was broken.

The writer has under his charge a hydraulic dredge used on the Mississippi river improvements in the vicinity of Keokuk, Iowa. This dredge is driven by a compound high-pressure engine, with cylinders 14 and 24 in. in diameter by 15-in. stroke, running 220 R. P. M. and developing about 250 H. P. The steel shaft of this engine, 6 in. in diameter, broke about 10 in. from one of the cranks.

The cranks are quartering, and the shaft is a highly finished one that takes a long time to build, even under the best of circumstances. It was, as you can see, a difficult task to weld this shaft so as to repair it, as the stub-end was so close to the crank that to heat it sufficiently was likely to warp the latter out of shape and spoil the whole shaft. The attempt was made, however, and the shaft promptly broke again at the same place, although a whole week and a large expense had attended the effort to put the shaft in working condition.

At the suggestion of a traveling engineer, we simply squared the two broken ends and screwed them together with a stud that went half into each piece of shaft. Squaring the ends shortened the shaft some 6 in., but this could be remedied by moving in the outboard pillow block. A chunk of soft and tough steel, that had once done duty as a wristpin for a large engine, was selected from the scrap pile. This was cut off 10 in. long and turned to 4 in. in diameter; it was then threaded the whole length with a screw of four threads to the inch; each piece of shaft was then bored and threaded to fit this screw, and when finished the stud was screwed into one piece of shaft, and the other piece screwed home. To make the job a little more solid, the stud was dipped into salt and water to make a rust joint of it, and keep it from coming unscrewed by any chance.

It took an afternoon and part of the night to complete this job, and the next morning the shaft was replaced in the engine and put to work. It has never shown the least indication of weakness so far, and is still, after 18 months, apparently as good as ever. The new shaft, ordered as a hurry job, was received in two months, but is still kept in reserve. The joint between the two pieces of shaft was fortunately an inch or so inside of the pillow block, and is now undistinguishable from the rest of the shaft. The work of the engine, of course, always tends to screw the pieces tighter together; but it seems a little surprising that the threads do not strip off and let the two pieces separate. Probably the friction between the outer parts of the shaft takes up most of the torsional strain. The 4-in. stub would not last a minute by itself.—*Scientific American.*

FERRO-CONCRETE FOR SHIPBUILDING.

An article in the engineering supplement of the London *Times* describes the use of ferro-concrete for ship building purposes. It describes several barges built for the Italian navy of this material, the thickness of the skin being but little more than an inch, for barges of several hundred tons burden. The metallic framework, or skeleton of reinforcing iron is arranged in accordance with the actual distribution of stresses, and this frame is covered with expanded metal, which supplements the protective action by the distribution of the armoring over a large area, while it unites the various portions of the mass in such an effective manner as to preclude any risk of fracture. This process dispenses with the provision of molds and renders it permissible to employ extremely thin walls to serve as the outer skin. Owing to the metallic reinforcement, the concrete mass, instead of being fractured by sudden shocks, undergoes an elastic deformation, but immediately resumes its previous shape when the strain is removed.

The first ferro-concrete boat to be constructed on this system was built in 1897 and was about 18 feet long by 5 feet wide. The thickness of the sides was only about ½ inch. The first canal barge to be built on this system was constructed in 1902 for a burden of 50 tons, and has since been in continuous use in connection with engineering work on the river Tiber. The Italian navy ordered the first boat in 1906. These have a burden of about 100 tons each, and have double skins and water-tight compartments. The first cost of these ferro-concrete boats is less than that of iron vessels of equal tonnage, and the expense for upkeep is practically nil.

NEW HUDSON RIVER STEAMBOAT.

An addition to the fleet of fine passenger steamboats plying the Hudson river was made Oct. 26, when the Trojan, building for the Hudson Navigation Co., was launched at the yard of the T. S. Marvel Ship Building Co., at Newburgh. It is expected that the Trojan will be completed and in commission next season. She is to run to Troy. A sister ship of the Trojan, also for the Troy service, is under construction at the same yard as is the Princeton, building for the company's Albany service.

The Trojan is 330 ft. long, 76 ft. beam over guards, 42 ft. beam of hull and 13 ft. 9 in. deep. She will draw 8 ft. 6 in. of water. There are more than 250 staterooms, some of them with private bath. The staterooms will be carried in three tiers above the main deck, with a central grand saloon and wide staircases communicating with the various tiers. Her steam will be generated in four boilers and delivered to a surface condensing beam engine of similar type to those which drive the two latest Night Line steamboats. The engine will be of 70 in. diameter of cylinder, with 12-ft. stroke, developing 4,000 horsepower, and producing a speed of 18 knots an hour through feathering paddle wheels. The Trojan will be equipped with powerful searchlights, and will have a wireless telegraph outfit.

TWO CAPTAINS SUSPENDED.

The New York board of steamboat inspectors has announced the suspension of two skippers of large passenger-carrying craft because they allowed persons in the pilot house while navigating the bay with passengers on board. The convictions were for violation of section 19 of rule 5 of the Rules and Regulations, a section which has been looked upon by many skippers as a dead letter.

During the summer one craft came to grief on the Hell Gate rocks, and it was then reported that the skipper had been entertaining a party of friends in the pilot house when the boat struck. Such reports became rather numerous, and inspectors were detailed to keep an eye open for violators of the law.

Capt. E. Hubbs, of the Patten liner Elberon and Capt. Henry B. Edward, of the steamer Little Silver of the same line, running from the Battery to Long Branch, were tried for having persons accompanying them in the wheel house. Both men were tried by the board of inspectors. Yesterday it was announced that they had been suspended for 10 days and fined in addition.

DEADLY NEW TORPEDO.

Further details have been received of a new British torpedo which is a marvel of speed, range, accuracy and destructiveness. Its general features may be thus summarized:

Diameter, 21 in.

Range, 7,000 yards (about four miles).

Speed, 31 knots.

Explosive charge, over 200 pounds.

Of late years greater attention has been devoted to the torpedo in all fleets, in view of the increased recognition of its role in naval warfare. The modern torpedo is a terrible weapon, in itself a complete mobile ship of war. Though weighing only 1,218 pounds, and with a length of but just over 16½ ft. and a diameter of 18 in., it carries 190 pounds of guncotton. It is as much a ship as a submarine torpedo boat. Divided into various sections, it comprises a head, carrying the explosive, with a pistol to fire the charge on impact; an air-chamber containing the motive power of compressed air at a pressure exceeding 2,000 pounds per sq. in.; the balance chamber with the intricate mechanism for keeping the torpedo at any desired depth in the water; the engine room, which contains the propeling engines, the servo-motor for actuating the horizontal rudders, and the counter-gear for making the range adjustment, the buoyancy chamber, which holds the tubes through which pass the main propeller shafting and the diving rod for working the horizontal rudders; and, lastly, the tail and propellers, the latter numbering three in the latest type.

The new British torpedo resembles the torpedo now in use in most essentials. The existing weapon has a diameter of 18 inches, and the new one is of 21 in. The increase in size enables a heavier explosive charge to be carried and more powerful engines to be installed. But the revolutionary change is in the motive power. Before the Dreadnought was built it was known that we were on the eve of developments in torpedo manufacture which would force battleships to fight at five or six miles' range at least, if they would keep outside the reach of the enemy's torpedoes, and at this distance the familiar 6-in. gun was comparatively ineffective. Therefore word went forth for a ship to carry only the biggest and most powerful guns. If the war in the far east had not shed light on naval gunnery, the Dreadnought, with its all-big-gun armament, would be justified by the new torpedo. The remarkable increase of speed and range is due to a simple cause. Some time ago an American hit on the idea of heating the compressed air used in propeling the torpedo. The trials were encouraging. Messrs. Armstrong, Whitworth & Co. later on evolved a type of heater that gave most remarkable results. The application of the heater to the familiar 18-in. torpedo at once raised its range to four thousand yards with a speed during the entire run of 28 knots—an increase of speed of 8 to 10 knots, due entirely to the simple process of heating the compressed air.

It is understood that, apart from the increased charge carried, the new torpedo has an improved type of gyroscope for keeping it on its course. It runs consequently more consistently than even the present one. This is the new weapon which will be fitted in all new British men-of-war. In view of the increase of the range of the torpedo to just upon four miles, battles must be fought in future with guns of the largest size only. The development of this new weapon illustrates once more the remarkable sequence in naval evolution.

TRADE NOTES.

The Submarine Signal Co., Boston, Mass., has been awarded contract by the lighthouse board, Washington, D. C., for eight submarine signal bells. Their bid of $4,000 was the only one submitted.

The Hardy Paint & Varnish Co., Toledo, has just issued a card containing a diagram of their August business for the past five years. The diagram shows that the business for last August was a gain of over 62.8 per cent over the average for the past five years and is a gain of 53 per cent over the business of August, 1907.

The Akers Steering Gear Co. have made arrangements with Matteson & Drake, 59 Pearl street, New York, to represent them as selling agents for the Atlantic coast. The Akers steering gear, which is an auxiliary steam steerer, has met with much success on the lakes and will undoubtedly prove equally successful on the coast as soon as its merits are understood.

The Brown Hoisting Machinery Co., Cleveland, O., has just issued a little catalog descriptive of "Brownhoist" machinery as adapted to the use of artificial gas, coke and electric light companies for the rapid and economical handling of coal, coke and other materials. A few illustrations are given of some of the types of machines manufactured by this company. The Brownhoist fast plants for unloading directly from boats, the unloading and storing bridge, electric man-riding grab bucket trolleys, over-head traveling cranes, are in use in many of the largest plants of the country. Special attention is directed to the Brownhoist locomotive grab bucket crane. Not only can these cranes be used to unload or rehandle coal or coke, but they can be used with a bottom block in the handling of miscellaneous loads. The catalog will be sent to anyone interested upon request.

The Cleveland branch of the Western Disinfecting Co., of New York, is now installed in larger quarters at 1690 West Third street. The Cleveland branch carries a complete line of disinfectants and dsinfecting appliances. It has also added a cleaning department and cares for all of its installations without extra charge to its customers.

The French submarine Turquoise was launched from the Mourillon-Toulon yard recently. She is the last of the group of four to be constructed there. The Turquoise displaces 390 tons, has 600 I. H. P. motors, and is designed for a speed of 12 knots. Her armament consists of six torpedo discharges and she will carry a crew of 21 men. She will be attached to the channel fleet.

The Consolidated Supply Co., Manhattan building, Chicago, has just issued loose leaf catalog No. 15. Attention is called to the Consolidated patented metal car roof just placed on the market, although having been tested out on a car for the past five years. The company is also putting out a new malleable tie plate, on which it has enjoyed quite a sale and on which patent is pending. The company is in position to quote low prices on boiler and tank work, bar iron and castings. It represents the Reading multiple geared chain hoists and also the Monarch couplings for engines and cars.

"Boiler Troubles and Their Prevention," is the title of a 48-page treatise just issued by the Bird-Archer Co., 90 West street, New York. This book will interest all who own or operate steam boilers, for it explains corrosion, scale, oil and grease deposits and what harm they may do. It tells what scale consists of, how it collects, resulting loss in fuel and steaming capacity, dangers from overheating, cost of mechanical cleaning and the advantage of boiler compounds in preventing scale, oil deposit or corrosion. It further discusses every method of water and scale treatment, gives valuable advice on feeding boiler compounds, the care of blow-off valves, etc. Copies may be had free by addressing the Bird-Archer Co., 90 West street, New York.

ADVERTISERS

The Star indicates alternate insertions, the Dagger once a month.